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The Electrical Review

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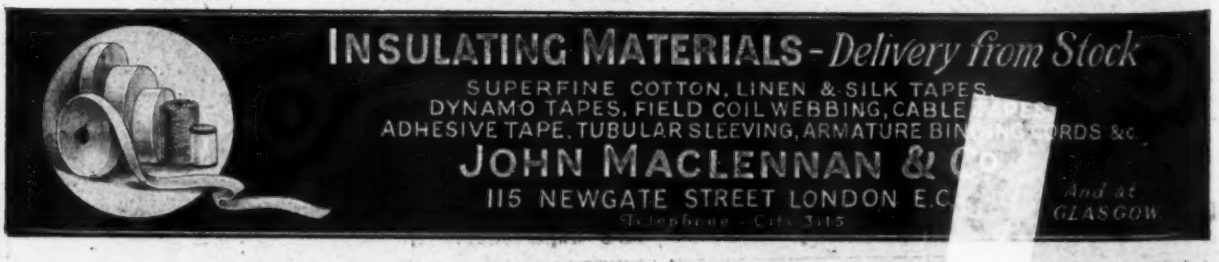
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ELECTRICAL REVIEW.

Vol. LXXXIX.] CONTENTS: September 2nd, 1921. [No. 2,284.

	Page
British Financial Policy	297
Electricity in Mines	298
The British Association	298
Classics and Business	299
The Engineers' Club (London)	299
Mr. George Ellison's Switchgear Works (*illus.*)	300
Notes on the Grinding of Commutators, by Owen Linley	302
Submarine Tests with the Neale Electromagnet (*illus.*)	303
The Allocation of Boiler-House Working Costs in Reducing Steam Engine Plants, by T. E. Houghton (*illus.*)	304
A High-Frequency Induction Furnace (*illus.*)	305
Industrial Research	305
Correspondence—	
A Motor Problem	306
The Electrical Trades Union and Non-union Labour	306
Overhead Transmission Costs	306
Carpets and the Electric Suction Cleaner	306
Accumulator Froth	306
Trade Terms and Direct Trading	306
Country House Lighting Sets	307
The E.P.E.A. Schedule and Economy Stunts	307
Foreign Competition	307
Oil Consumption and Prices	308
Testing and Repairing Magnetos	308
Legal	308
Business Notes	308
Notes	314
City Notes	318
Stocks and Shares	320
A Note on the Interconnected-Star Method of Connecting Three-Phase Transformer Windings, by S. Austen Stigant, (*illus.*) (*concluded*)	321
Reviews	322
Future Prospects in Hungary and Poland	324
New Electrical Devices (*illus.*)	325
The International Tramway and Light Railway Association	326
Signalling by Invisible Rays	327
New Patents	328
Published Specifications	328
Contractors' Column ... Advertisement page	xxx

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BRITISH FINANCIAL POLICY.

THE address of Mr. Edgar Crammond to the Institute of Bankers ought to be circulated at Government expense for the education of the nation. Though many people might cast it aside as dealing with a dull and difficult subject, intelligent persons who began to read it would in all probability read it to the end, as the facts set forth are of supreme importance, and the form of the address is clear and in every way excellent.

The speaker commenced by comparing the national income of 2,400 million pounds in 1913 and 4,400 million pounds in 1920—a nominal increase of about 2,000 million pounds, or 83 per cent. increase over the national income of 1913. This increase was, of course, not represented by a corresponding increase of the national production for 1920, which as a matter of fact was 20 per cent. below that of 1913. It was due entirely to inflation of values.

Mr. Crammond gave an analysis of the manner in which the national income was spent in 1907 and 1920. He pointed out that the most striking features were an increase in the percentage of the national income spent on food (including drink) in 1920 as compared with former years, and an enormous increase in the cost of national services. In 1907 the cost of national services was 8.5 per cent., whereas in 1920 it had risen to 23 per cent. of the total national income.

He proceeded to show that the same economic forces which carried the nominal national income up were now carrying it down with even greater rapidity. The highest point of prices of commodities shown by the *Statist* Index Numbers was 266 in April, 1920, whereas at the end of May, 1921, the average had dropped to 162.2. In fact, prices had fallen three times as rapidly as they had risen, and it was not quite certain that the end had been reached.

We should like to point out, as we have done before, that the Excess Profits Duty has had a very large share of responsibility with regard to the fall in prices in general, as manufacturers and merchants were glad to throw their stocks on the market at any price so long as they were in a position to set off their losses against the Excess Profits Duty, which they would otherwise have had to pay.

Foreign trade returns (imports and exports) show a falling off of 41.7 per cent., and the earnings of our shipping a decline of 23 per cent. in the first five months of 1921, as compared with the same period in 1920.

Mr. Crammond estimated that the national income for 1921 would not exceed 2,800 million pounds, whereas the budget for the present year provides for an expenditure of 1,039 million pounds. This, however, is by no means the worst of it, as it is now clear to everybody that the Budget will be down on the receipts side by many millions and up on the expenditure side also by many millions, and as a matter of fact the position is very much worse than it appeared on the Budget figures. The revenue return for the first two months of the current year showed a decrease of 100 millions. It is already apparent that it is a sheer impossibility for any great industrial nation in urgent need of capital to afford anything like 32 per cent. of its entire national income for the purpose of national services, which is Mr. Crammond's estimate for the current year. On the Budget Estimates we should all (or rather all those of us who are at work) have been working for four months out of the twelve for national services, but in view of the worsening of the position since the Budget was intro-

duced it would appear that six months out of the twelve would be nearer the mark.

Such are the facts as set forth without any unnecessary comment by Mr. Crammond. The second half of his paper was devoted to the question of the policy which must be adopted to meet this appalling situation.

In the first place, Mr. Crammond estimated that if the real wealth of the country increased in the same proportion as formerly, we ought to be able to pay off the war debts in the course of the next two generations, but in order to achieve this result it is evident that we must adopt a policy which will enable our manufactures and our volume of trade to be restored and increased above the former rate. In this connection Mr. Crammond pointed out that the economic interests of Great Britain and France were not quite identical. We have over two million persons registered as unemployed, while France has only a hundred thousand. Great Britain is mainly a manufacturing country, while France is mainly an agricultural country. Our exports for the first five months of this year show a decline of 36.5 per cent., whereas the exports of France during the same period show an increase of 12.7 per cent. The effect of the German indemnity as at present settled is shown to be that Germany, in order to fulfil her external obligations, must increase her exports (which will, of course, be chiefly manufactured goods) up to 16 hundred or 18 hundred millions per annum. In the past Germany has supplied one-tenth of the world's consumption of manufactures, whereas in the future she will, in order to fulfil the terms of the Reparations Settlement, have to increase her share to 40 per cent., taking the place of a corresponding proportion of competitors' goods.

Mr. Crammond's most important proposals might be summarised very briefly, as requiring first an enormous cut in the cost of our national services, and the total of our national Budget; secondly, a greater proportion of contribution to the needs of the Empire by the Colonies and Dependencies; and thirdly, he urged that either with or without similar action on the part of the United States we should cancel the war debts owed to us by our Allies, and also, if thought desirable and possible, the war debts owed to us by our Colonies, thus setting our debtors free to order and pay for more of our goods. His view was that if on the contrary we continued to collect interest and repayment of these war debts, we should lose far more than the sums they represented in the reduction of our export trade. Mr. Crammond did not suggest that the United States should cancel our debt to it of one thousand million pounds, but he did suggest that the United States, with great advantage to itself and us, might cancel the debts due to it by the other Allies in the Great War.

The only alternative to some such strong remedial policy is that we shall have to relinquish a great proportion of our foreign trade; and Mr. Crammond pointed out that if the people of these islands became self-contained and self-supporting, it would only be possible to support a population of 20 millions, and the other 26 millions or so would be compelled to seek occupation abroad.

We trust that this extraordinarily illuminating statement of the present state of our financial affairs will receive the attention of the whole British public.

ELECTRICITY IN MINES.

An excellent little publication has been issued by the Mines Department and published by H.M. Stationery Office, which should certainly be in the hands of every colliery manager and electrician, as no doubt it will be—and we would certainly recommend every one engaged or interested in the manufacture of mining electrical plant to obtain a copy * without delay.

Its value lies in the explanatory memorandum forming Part II, and covering 54 out of its 73 pages—which is the official interpretation of the "Regulations" as given in Part I.

The first regulation relates to "the duty of the mine owner, agent, or manager to comply with and enforce the regulations," but there is also a duty laid upon *all employés*, and particularly those who operate the plant, to carry out their work so as to comply with the regulations. It is of little use to install first-class plant unless this is adequately maintained and properly worked, and therefore it is pointed out that improper use, or interference, or gross negligence, may cause a breach of the regulations, and render a "safe" piece of apparatus dangerous to handle or operate. The whole of the plant, therefore, is to be under the effective supervision of the "electrician," and it is the duty of the manager to ensure that the former satisfactorily carries out his duties. The "electrician," or in cases where the size and complexity of the plant requires them, "assistants," must be appointed in writing, and their duties properly apportioned. Moreover, the "electrician" must be in daily attendance at the mine, and if he be absent for more than one day, the manager must appoint an efficient substitute. On the question of efficiency or competence, it is pointed out that an assertion of competence by the person appointed will not absolve his superior from responsibility, but it is the duty of the "electrician" to satisfy himself by observation and instruction that the person selected to assist or operate any machinery does really understand the work, and is capable of performing it without "danger." A "log-book" must also be kept, in which all records and tests must be entered as evidence of such work being duly carried out, but apart from the legal aspect of this matter, it is quite rightly pointed out that a concise and systematic record is of great value in securing proper maintenance, in forestalling breakdowns, and in avoiding interruption of service.

Notes on the various notices and returns to be given to H.M. Inspector for the Division, and notices to be exhibited against "unauthorised interference," in case of "fire," and "electric shock," are given, the latter being especially interesting, as showing how important it is to resort to, and persevere with, artificial respiration. The notes on "Working space and access to apparatus," "General requirements for avoidance of danger," "Switchgear cables," and "Earthing," are dealt with in a practical and common-sense way, and should be read and carefully studied by those concerned in the management and control of electrical apparatus in and about mines.

Undoubtedly the publication is intended to assist and help those in charge of mining plant thoroughly to grasp and understand clearly the meaning of the regulations which are designed for the sole purpose of safeguarding life and property, and which, to this end, should be faithfully studied and obeyed.

* Coal Mines Act, 1911. General Regulations as to the Installation and Use of Electricity, with Explanatory Memorandum. Mines and Quarries Form No. 11. (April, 1921.) One shilling net.

The British Association.

On Wednesday next the eighty-ninth annual meeting of the British Association for the Advancement of Science opens at Edinburgh, where, exactly 50 years ago, Lord Kelvin (then Sir William Thomson) presided over a meeting in which electricity took a most important part.

This year, as was the case at Cardiff in 1920, the matters which will occupy the attention of members are not predominantly electrical, although a number of topics of interest to electrical engineers will be discussed. The proceedings of Section G—Engineering—will embody at least three important contributions to the study of the utilisation of water power. In his address the President of this Section, Prof. A. H. Gibson, will give a review of the subject; Dr. T. F. Wall will present an ingenious scheme for overcoming some of the difficulties raised by the varying force of tides; and Prof. F. C.

Lea will also deal with the subject of tidal power. In this Section, also, Mr. S. B. Donkin is to contribute notes on the new power station of the Corporation of Edinburgh, and Mr. J. Scott-Taggart will describe two new negative-resistance devices for use in wireless telegraphy.

In the Mathematical and Physical Science Section (A), the President, Prof. O. W. Richardson, will deliver an address on "Problems of Physics." "The Einstein Theory" will be dealt with by Prof. Eddington, and the Rev. A. L. Cortie, of Stoneyhurst, is to read a paper on "Magnetic Storms of the Present Solar Cycle." Wages and conditions in industry naturally, at this time, find an important place in the Economics Section (F). Miss G. Jebb is to discuss "The Cost of Living and Sliding Scales," and a paper on "The Breakdown of the Minimum Wage" is to be contributed by Mr. A. A. Mitchell. Those who consider that, in this country, the limit has been reached, will await with some apprehension Sir Josiah Stamp's paper on "The Taxable Capacity of a Country." Dr. Mary Ranken will speak on "Arbitration in Recent Industrial Legislation."

An endeavour has been made this year to arrange that there shall not be more than two sectional addresses or important discussions in progress simultaneously, and another innovation is the decision to permit discussions upon sectional addresses.

A number of visits have been arranged, and it is to be hoped that the weather will be favourable, although no doubt Edinburgh needs rain as badly as the rest of the Kingdom.

Classics and Business.

At the beginning of last month, Dr. Walter Leaf, who is one of the leading bankers in the City of London, and who is also chairman of the Classical Association, delivered an address at Cambridge to a distinguished company, including representatives of the American Philological Association.

Dr. Leaf began his address with a reference to the tightening of intellectual bonds between this country and the United States, and as evidence of the vigour of the classics in the Middle West, he spoke of a meeting which he attended in Chicago where they sang "The Star-spangled Banner" and "Three Blind Mice" in Latin. He also referred with the relish of the scholar to certain discussions upon passages from Thucydides which had taken place at the board meeting of an electricity company in London. He referred to the popular estimate of the Classics having been at its lowest in the early stages of the war, when it seemed that nothing could win a victory but pure science; and that no education which did not lead directly to the discovery of a new poison gas was worth the attention of rational people. There was a jeer at some statesman who did not know the origin of glycerine, and it was inferred that no one could lead the people in war if he did not know the chemistry of fats. Dr. Leaf rejoiced that there was now clearly a reaction against that extreme view, in favour of the "Large humanism" based upon the classics. He said that classical teaching produced the power in dealing with men for putting oneself in their place, in sympathy with their ideals and sentiments; and said that this precious gift had never been more needed than now in the constant expansion of international relations in business of every sort.

While we have the greatest respect for Dr. Leaf as a scholar and a business man of the greatest eminence, we are bound to say that we differ from him fundamentally on the subject of education. If science is really losing ground as compared with the Classics, it is in our view only to be deplored.

Either the whole educational mechanism would have to be immensely speeded up, or the educational period of life would have to be greatly lengthened to enable the average student to become a classical scholar as well as a scientific man. Even regarding the classics merely as a medium for exercising and enlarging the thinking faculty, we doubt if anything less than scholarship is of much use. The ordinary grounding in Latin which enables a boy to read "De Bello Gallico" with difficulty and loathing is, in our view, a waste of time which would be much better spent in obtaining a knowledge of modern languages. In any case, it seems to us perfectly clear that any man who is to succeed in any branch of applied science will only do so provided he gives practically the whole of his time to science from the age of 15 upwards. The "large humanism" of which Dr. Leaf speaks is not, so far as we are able to learn, regarded by the business community as a prominent feature in the make-up of the bankers of to-day; and if, as we believe, a very large proportion of the persons ruling us from official and semi-official armchairs have either received a classical education or practically none at all, it does not seem to have saved them from making an impossible mess of the nation's affairs, financial and political.

We hold that what is required to-day in executive chiefs is not so much an acquaintance with dead languages as of living men; and we hold that a year's commercial travelling on the Continent would help a man more to understand and sympathise with the foreigner's point of view than any amount of Latin and Greek. An elementary acquaintance with the science of Political Economy would be of more value to our Chancellors of the Exchequer than ripe classical scholarship. With regard to the nation's production, both in peace and war, if we were asked to choose between handing over as hostages to the enemy the whole of our classical scholars, or as an alternative all our chemists and engineers, we fear that we should promptly decide to part with the former. The experts in poison gas successfully used their brains and risked their lives in discovering the protective masks, and precious little thanks they got for it.

The salaries paid to chemists and other scientifically trained men during the war showed very plainly the value placed on their services by the classical rulers of the country. For our part, we look forward to a time when the rôles will be reversed, and the practical and scientific men will hold the reins. The country may then have a chance of recovery.

The Engineers' Club (London).

Yesterday, as we have previously announced, the Engineers' Club was to open its doors, and thus at last a project long cherished by those who had enjoyed and appreciated the amenities of its Manchester prototype has come to fruition. The difficulties—as we foreshadowed last December—that had to be overcome were great, perhaps greater even than the promoters anticipated, and it has taken many months of investigation and negotiation to surmount them; indeed, had not the Provisional Committee had the good fortune to enlist the whole-hearted and indefatigable support of Mr. E. L. Hill, one-time hon. secretary of the Manchester Club, whose enthusiasm never wearied and whose dictionary does not contain the word "defeat," we doubt whether the movement could ever have been brought to a successful issue.

We understand that the Club is to be above all an Engineers' Club in fact as well as in name, and that the qualifications of candidates in that respect will be strictly scrutinised; nevertheless, the term will not be interpreted so as to exclude those—architects, for example—who, while not usually classed as engineers, are intimately connected with that profession. The best way to find out whether one comes within the category of "eligibles" is to file an application, and as an entrance fee is to be imposed when this month ends, the sooner the better.

The membership roll is approaching 3,000, but there is ample accommodation in the spacious premises in Coventry Street for more than that number, which, of course, includes a large proportion of country and overseas members. Extending our congratulations to the Committee and the members, we wish the Engineers' Club every success.

MR. GEORGE ELLISON'S SWITCHGEAR WORKS.

Not very often does one come in contact with an establishment that was initiated for the set purpose of producing a commodity and which has continued throughout the whole of its existence to manufacture the same product and that one only. Yet such is the history of Mr. Geo. Ellison's undertaking at Perry Bar, Birmingham, the more recent extensions of which we had the pleasure of viewing last week. These works, which have been laid out and built with much care and forethought, are devoted exclusively to the design and construction of electric control gear for industrial installations, and are worthy of note inasmuch as they possess several features uncommon to similar establishments.

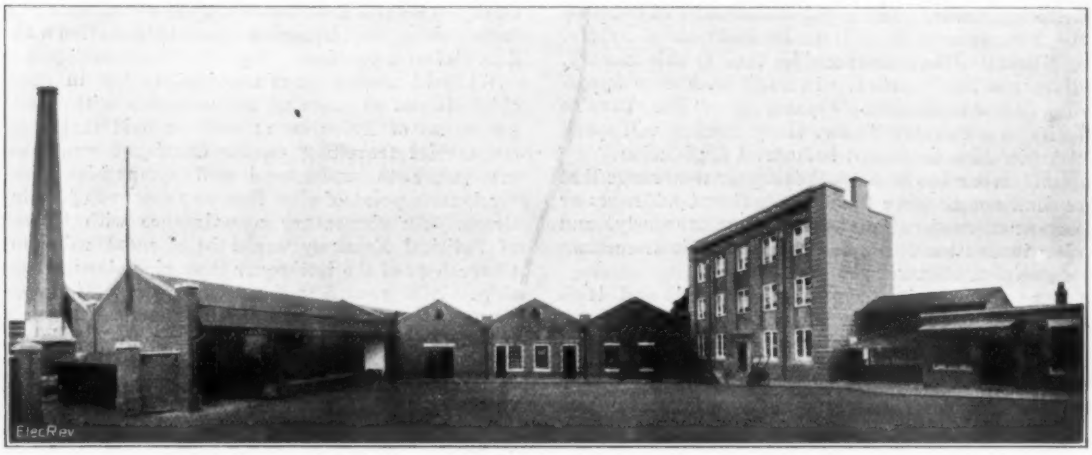


Fig. 1.—Office and Stores Frontage.

Foremost amongst these is the fact that in contrast to the more or less co-operative method of governing most industrial establishments, this concern is controlled autocratically by one man. No female labour whatever is employed, and every employé without exception is paid by time—no piece or night work is allowed—and strange as it may seem to some, the policy adopted answers splendidly, and none but the most cordial relations exist between Mr. Ellison and his employés.

By concentrating upon one line of manufactures, the firm has been able to gather together a specialist staff, and has acquired unrivalled experience in the successful design and construction of industrial switchgear. Standardisation and interchangeability are insisted upon wherever possible, and the special conditions imposed by the character of the work, such as mistake- and weather-proofness, dust-tightness, simplicity, strength, compactness, and above all, reliability, are fulfilled in no uncertain manner. It must be added that the solutions of the problems encountered in this respect are not always the cheapest, but they are sound, and that is what really matters.

A view of the office and stores frontage is given in fig. 1, which shows the goods receiving deck on the left and the new research house and office accommodation that is nearing completion on the right. The smoke stack seen in the illustration belongs to the refuse destructor, the heat from which is utilised to warm the establishment. The whole works are thoroughly well lighted, both naturally and artificially. Fig. 2 shows the main bay assembly benches, with a part view of the machine shop on the right; the works are electrically driven throughout at a pressure of 440 volts, which is stepped down in the works substation from the public supply pressure at 5,000 volts. Fig. 3 is a view of the test room, while fig. 4 shows a "Unit" type distribution board, including oil-break,

Fig. 2.—Main Assembly Bay.

circuit breakers and busbars; it is made for all industrial purposes, and is intended to cover the field between the ordinary switch and fuseboard and the elaborate cellular ones for large power stations. The arrangement lends itself to the building-up of quite complicated boards, yet each part is simply and robustly constructed.

The open circuit breaker illustrated in fig. 5 is of practically the same design as the breakers which were selected for use on the Paris tramway system in 1899, after severe tests in competition with other well-known makes. Since then the only alterations which have been found necessary are in details, in order to cheapen and simplify the manufacturing processes. The breakers are mounted on slate bases and are made up in numerous combinations of single, double, triple and four-pole patterns, with or without magnetic blow-outs, open type or with protecting covers. Every form of automatic feature is provided, and they can be supplied to satisfy any condition for which switchboard circuit breakers may be required. The exceptionally long carbon break and the simplicity of design are factors in the success of the breaker. There are six standard sizes, for currents ranging up to 3,500 amperes. Finished parts are stocked to enable the works to supply promptly any of the 20,000 variants which are possible with the different sizes, types of handles, number of poles and automatic releases, blow-outs and covers, interlocks and contactors.

Fig. 3.—Test Room.

The crane control panel shown in fig. 6 is part of the Ellison patented system of complete electric crane control equipment for d.c. and a.c. motors, which also includes controllers, resistances, limit switches and brake solenoids. All live parts are enclosed, and the panels comply in all respects with the requirements of the Home Office and Factory Acts. The gear on each panel includes a main air-break circuit breaker, with overload and no-volt releases, of ample size and breaking capacity to interrupt the supply with safety and certainty under the worst conditions of service, and to isolate the whole of the electrical gear on the crane when the supply fails; an overload inverse time-element relay in the circuit of each motor, to trip the main breaker when a motor is overloaded or fails; pilot lamp with plug, socket and switch, and indicating instruments if required. This method of employing one circuit breaker only reduces the number of elements to the minimum and increases the ease of manipulation. It is convenient for a quick re-start after a temporary stoppage, and there are no troublesome fuses to "blow" and be re-wired.

There are many situations in factories and non-fiery mines where a convenient plug arrangement for connecting up portable tools is of great utility, and a suitable fitting is made by the firm to facilitate the use of trailing cables and sockets and plugs for air-break gate end boxes. A substantial socket and plug are mounted direct on a standard "Mill" type circuit breaker, and the plug is interlocked with it to prevent the plug being withdrawn while current is flowing. A similar piece of apparatus is illustrated in fig. 7, being an oil-break circuit breaker mounted on a stand with an interlocking plug and socket for use as a gate end box; the plug is shown removed and a cap screwed over the socket.

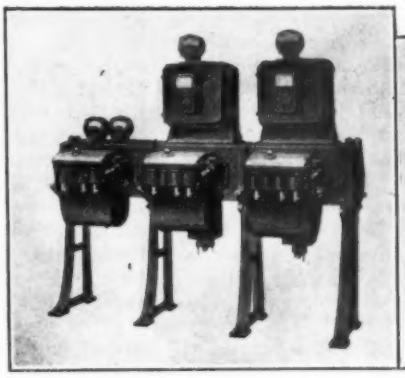


Fig. 4.—"Unit" Type Distribution Board.

Fig. 5.—Open Type Circuit Breaker.

These few examples of Mr. Ellison's products will

serve to show that he is thoroughly acquainted with the methods of combining a maximum of those good qualities which go to the making of reliable apparatus and also of satisfactory manufacture. The subject of interlocking and correct sequence of operation is, in any case, of vital importance, and the care and thought that has been devoted to the problem ensures that the apparatus works satisfactorily and safely however unskilled the personnel under whose charge it may be.

From the electrical point of view, the switchgear is equally worthy of study. The fixed and moving contacts are separately attached to their supports, are readily adjustable for wear, and are easily replaced. The oil-cooled rotor starters made by the firm are of special interest; they are designed for starting slip-ring induction motors, and are weather-proof and dust-tight. They control the rotor circuits only, and separate circuit breakers should be used for the stators. Starters are built up to 1,500 b.h.p. and 1,000 amperes rotor current.

The contacts and resistance elements are submerged completely in oil. The contact dial is at the bottom of the tank under a very ample head of oil, and in the coolest part, eliminating danger, which otherwise might occur if the oil level falls. The complete starter can be removed bodily from the tank for inspection.

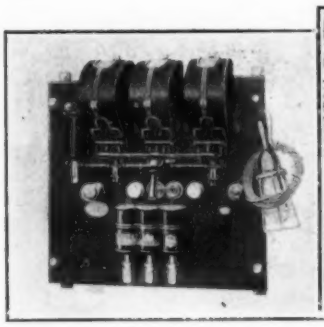


Fig. 6.—Crane Control Panel.

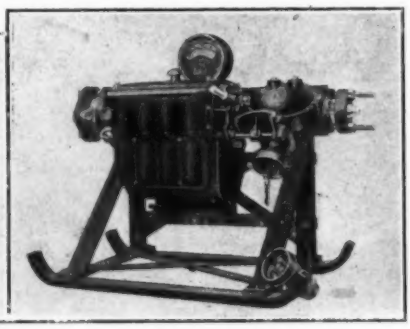


Fig. 7.—Gate End Box.

The moving contacts consist of heavy copper rollers, which are free to rotate and swivel on copper ball joints carried on a brass spider. They are forced against the fixed contacts by strong springs, so located that each roller is positively controlled and can surmount a roughness or obstacle on the dial without relieving the pressure on the others. The rollers are, therefore, self-seating and self-aligning.

The resistance element consists of a wire of high resistance alloy with a negligible temperature co-efficient that is wound on strong stoneware cylinders which support the wire throughout its length, and being threaded, effectually prevent short circuits from turn to turn.

A slow-motion device is fitted to the operating mechanism, thus ensuring a quick movement from contact to contact, but with a pause at each contact.

In concluding this brief survey of the Perry Barr works, it remains to be said that no amount of care in design will produce satisfactory plant if the workmanship is indifferent. But such a contingency is avoided by the amenity of the conditions under which the employés work. They are allowed privileges, such as smoking during working hours, which are not tolerated in other establishments; excellent cloak-room and canteen facilities are provided—and it pays, because a satisfied workman gives satisfactory service.

A Strike at Lima.—The railwaymen and electricians here have gone on strike, and the tramway employés and workmen in the factories are taking sympathetic action. It is feared that a general strike will be declared.—*Reuter's Trade Service* (Lima, August 3rd).

NOTES ON THE GRINDING OF COMMUTATORS.

By OWEN LINLEY.

When the bars of a commutator begin to show signs of the development of flats, it is necessary for these to be removed.

Performing this operation by turning is open to many objections. Those who have had any experience in turning copper know how troublesome that metal is to operate on under ordinary conditions, and in the case of a commutator it is worse, for the following reasons: First, the metal has been hardened by the friction of the brushes, and the bars, not being very rigid (especially towards the centre), are inclined to spring, so that the curve produced by the tool does not coincide with the circle of the commutator, as it should do. Moreover, the tool, as it leaves the bar, is apt to tear off small portions of the metal, and these are likely to break the mica. Apart from these matters, there is another point which should be considered as regards turning a commutator in a lathe. Every one who has had much to do with turning will have noticed that it is very seldom that anything will run true in a lathe other than the one in which it was turned.

This is mostly due to the carelessness of turners as regards the state of their centres and the countersinks in the ends of the shafts of the commutators. A commutator should be trued or corrected when running in its own bearings, under its normal conditions and speed, and not on its centres. There is also to be considered the time and trouble spent in getting the commutator in and out of its place.

There is now no need to attempt to turn a commutator or take it out of the dynamo. There are machines for grinding commutators so designed that they can easily be attached to any type of dynamo. Some are specially designed for dynamos on board ship (although they can be used for other purposes), which as a rule are erected close to the bulk-heads, thus allowing but little room for operating. This type of machine is invaluable when a commutator goes wrong at sea. Other types are designed for the motors of tramcars and electric trains.

The driving of these machines may be effected in two ways, in one of which the spindle which carries the grinding wheel is actuated by a rubber disk resting on the commutator itself, while the other and more elaborate type has its own motor, and is specially suited for turbo-generators and the largest sizes of dynamos, being able to grind up to 32 in. face and any diameter of commutator.

Many dynamo manufacturers use a machine in the first instance after the armature has left the ovens in preference to turning it in the ordinary way, as the work done by it is more satisfactory, the waste of copper less, and what is of the utmost importance, the mica is not disturbed.

When a machine has been obtained and is fixed up for grinding, its use is very simple, but there are certain points which should be borne in mind. One is to use the wheels which are supplied by the makers of the machines, as they have found out from years of experience the grit and grade which are most suitable for the purpose. Ordinary wheels are of but little use, as they quickly clog with the copper dust. Specially insulated wheels can be obtained when it is required to true up live commutators.

Again, in the actual application of a grinding machine, some users are inclined to allow the grinding wheel to press too hard on the bars of the commutator, being under the impression that they will get through

the work more quickly by that means. Experience, however, has shown that a wheel will do its work faster if it is run lightly in contact with the bars of the commutator. The best guide in this matter is the sound given out by the wheel while it is running. If this is a clear ringing sound, the wheel is working as it should, but, on the other hand, if the sound is dull and muffled, the wheel is being clogged. It is usual to use two wheels, a coarse one for roughing-down the bars of the commutator, and a finer one for finishing.

SUBMARINE TESTS WITH THE NEALE ELECTROMAGNET.

AN interesting and successful demonstration of the capabilities of the Neale electromagnet as applied to submarine purposes was carried out at the Albert Dock, Silvertown, on August 24th, in the presence of representatives of the Admiralty and the Port of London Authority, officials of many of the leading salvage and shipbuilding companies, and lighthouse and harbour authorities.

The magnet used for the test was octagonal in shape, 36 in. in width between opposite sides, 2½ in. in depth, and weighed, approximately, 7 cwt.

The tests consisted in depositing on the bottom of the dock by means of the magnet, swung for the occasion from a dock-side crane, several pieces of metal, varying from a portion of iron ship's plate weighing some 10 cwt. to three steel girders strapped together and aggregating about 2¼ tons.

At the time of the demonstration the depth of water in the dock reached 36 ft., and in the 5 ft. or 6 ft. of mud, silt, &c., on the bottom of it, the objects destined to be ultimately "fished" out by the magnet were promiscuously laid. As each of the objects had a considerable superficial area, the suction due to the presence of the mud added enormously to the work to be done by the magnet in the initial effort to lift the pieces to be "salved."

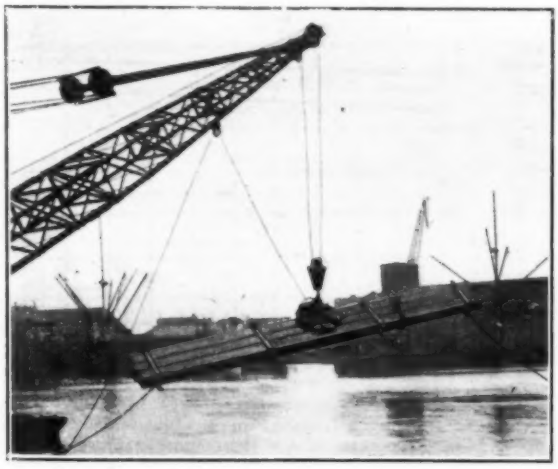


FIG. 1.—NEALE MAGNET LIFTING GIRDERS.

Without entering into constructional details, it may be stated that the Neale electromagnet has been so designed as to ensure the maximum pull on the object to be salvaged with the minimum weight of magnet and least expenditure of power.

To attain these desiderata it is essential to have the flux density in the iron as high as possible, and also to have a large area of pole face, both of which are ingeniously provided for in this magnet.

For purposes of description we may compare the magnet to an octagonal surface-plate, dimensioned as before stated and having at its centre a hollow with a radius of 6 in. The exciting winding is wound in four slots, cut round the face of the magnet, which is provided with an appropriate number of radial pole pieces. As in practice the actual contact obtainable will not be perfect, provision is made for such a contingency by having an extra number of ampere turns to allow for any air gap that may occur.

In this connection we may mention that one of the pieces we saw "salvaged" at the demonstration weighed approximately 16 cwt., and was lifted with clinker-impregnated mud interposing between quite 70 per cent. of the surfaces that should have been in metallic contact.

Owing to the sub-division of the poles the magnet can be designed to attain the greatest efficiency in handling any particular class of work, while the method adopted for cooling the magnet body and windings by water, or compressed air, the latter for land use, permits the windings to be operated at a high current density.

Owing to its general arrangement the Neale magnet, compared with the present stock magnet, has a greatly reduced weight and consequently lower crane power costs; a reduced power consumption for a given load giving lower running costs; and a lower first cost, due to the general construction being simplified, and the weights of copper and steel being greatly reduced.

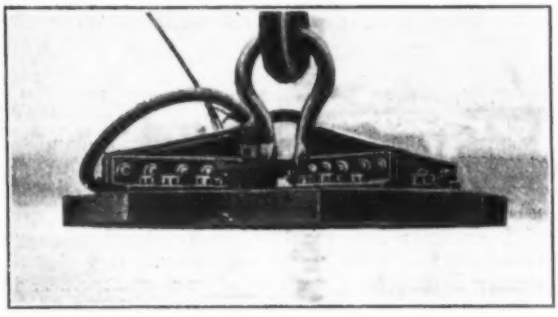


FIG. 2.—THE NEALE ELECTROMAGNET.

In a report comparing the efficiency of a Neale magnet with one of the ordinary stock type, it is stated that only 1 kW was absorbed by the former as against 8 kW by the stock type in performing a given task.

The weight of the Neale magnet was 7 cwt., as against 55 cwt. for the stock type, the lift in each case being identical, viz., two 12 in. by 12 in. by ¾ in. girders, weighing approximately 5,500 lb. The ratio of efficiency – weight × consumption of power—between the Neale and the stock magnet was 440 to 7, in this particular instance.

In the report upon a test recently carried out at the Faraday House testing laboratories, it is stated that for the purpose of the test a Neale magnet was placed in a tank of water, opposite a suitably stiffened ¾ in. mild steel plate, representing the side of a ship, and placed at an angle of about 30 deg. to the vertical, a projecting plate at the top representing a joint in the ship's side.

With a current of 9.3 amps. at 95.5 volts, the magnet slipped on the plate at 2¼ tons. When it reached the projecting plate, the pull was increased until the magnet became detached, at a load of 6½ tons. With 17 amps. at 200 volts, slipping occurred at 3 tons, and the magnet could not be detached at 9¾ tons, the maximum load which could be applied. On dropping the current to 14 amps. at a pressure of 165 volts the magnet came off at a pull of 8½ tons.

Similar tests with a gap between the magnet and the plate made by inserting about $\frac{3}{16}$ in. of cardboard gave the following results: With a current of 9.5 amps. at a pressure of 100 volts, the magnet slipped at a pull of 1¼ tons, and came away at 2 tons, while with a current of 18 amps., at a pressure of 200 volts, the magnet slipped at 4 tons, and came away at about 4½ tons. With double the gap mentioned and with a current of

9.5 amps. at a pressure of 101 volts, slipping took place at 12 cwt. and detachment at 15 cwt. On increasing the voltage to 200 and the current to 17 amps., slipping occurred at 2½ tons, at which stress the magnet also came away.

The invention which, it is gratifying to know, is British both in its inception and development, would appear to have an almost unlimited field of usefulness before it, particularly for holding work during a machining operation. It can also be used for the recovery of anchors and chain cables, the varied loading and unloading of steel sections from rolling mills to railways, and thence to ships' holds, the discharging of metallic ores, the lifting of machinery, even when encased in wood, and the recovery of some of the many thousands of tons of metal forming part of the war wrecks sunk around the coasts of the United Kingdom, many of which have been dispersed by explosions in order to remove obstructions to shipping.

The makers of the apparatus are the Neale Magnet Construction Co., Ltd.

THE ALLOCATION OF BOILER-HOUSE WORKING COSTS IN REDUCING STEAM-ENGINE PLANTS.

By T. E. HOUGHTON, B.Eng., Assoc.M.Inst.C.E.

In many industries there is a simultaneous demand for electrical energy and low-pressure steam for heating purposes. This problem is usually solved by the installation of a back-pressure or reducing prime mover which exhausts into the low-pressure heating system instead of the more usual condenser. Considerable economy results from the use of such plant since, in addition to the energy generated, low-pressure steam is obtained which would otherwise have to be supplied from a separate plant, and it is obvious that the efficiency of the reducing plant will be higher than the combined efficiency of separate generating and heating installations.

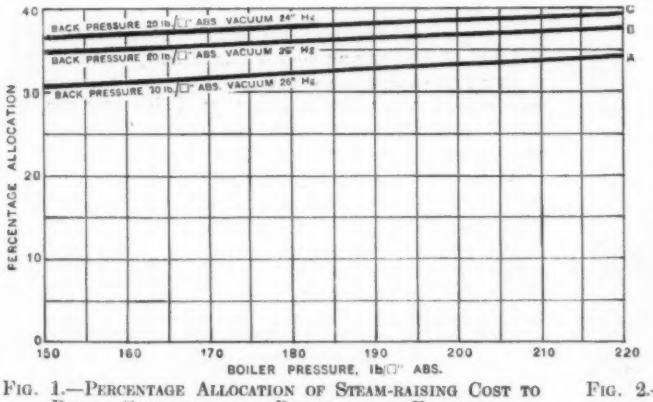


FIG. 1.—PERCENTAGE ALLOCATION OF STEAM-RAISING COST TO POWER GENERATION FOR RECIPROCATING ENGINES.

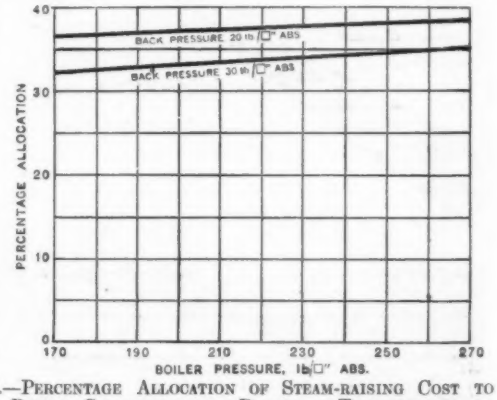


FIG. 2.—PERCENTAGE ALLOCATION OF STEAM-RAISING COST TO POWER GENERATION FOR REDUCING TURBINES.

Much doubt, however, appears to exist as to the correct method of allocating the boiler house working costs of such plant. Some engineers maintain that the whole of the steam-raising cost should be charged to the low-pressure heating system, the argument being that the boiler plant would be in use whether the generating plant existed or not and, therefore, the energy is obtained at the expense of engine-room charges only. Others affirm that a proportion of the steam-raising charges should be borne by the engine room, an arbitrary rule often used being 25 per cent. of the total boiler house running costs to be charged to power generation.

The latter method is undoubtedly the more correct of the two since, as power is required, the boiler plant works at a higher pressure than it otherwise would do, resulting in an increased running cost, and the generating plant should thus be charged with some portion of the steam-raising cost. The method, however, is open to criticism on account of its empirical nature, and the author, therefore, suggests that the following reasoning gives the correct proportion of the boiler house working costs, which should be allocated to power generation and low-pressure heating respectively.

It is assumed that the boiler pressure is 175 lb. per sq. in. absolute, and the exhaust pressure—*i.e.*, the low-pressure heating pressure—is 18 lb. per sq. in. absolute. Under these conditions the available heat according to the Rankine cycle is 170 B.th.u. per lb. of steam.

If the plant were put down for power generation only, it would, in general, exhaust into a condenser for efficient working. Assuming the maximum economical vacuum for reciprocating engines—26 in. Hg (bar 30 in.)—the available heat from 175 lb. per sq. in. absolute is then 295 B.th.u. per lb. In both cases the "Rankine efficiency" would be the same, and, therefore, the steam consumption condensing, and hence the fuel consumption would be 170/295 = 0.575 times the consumption of the back-pressure engine.

Further, if the boiler plant was only required for generating low-pressure steam, less heat per lb. of steam would be supplied by the fuel than in the case of the high-pressure boilers. Assuming the feed temperature in both cases to be 92 deg. F., the heat in the steam would be:—

(*a*) 1,135 B.th.u. per lb. for the h.p. boilers (175 lb./sq. in. abs.).

(*b*) 1,094 B.th.u. per lb. for the l.p. boilers (18 lb./sq. in. abs.).

Thus, for l.p. heating only the fuel consumption would be 1,094/1,135 = 0.965 times the consumption when generating h.p. steam. Evidently, then, if separate plant were installed for power and heating purposes, the fuel consumption under the best conditions would be 0.965 + 0.575 = 1.540 times the consumption of a reducing plant supplying power and l.p. steam.

Hence, the proportions of fuel consumption due to (1) power generation = 0.575/1.540 = 37.4 per cent. of the total, and (2) l.p. heating = 0.965/1.540 = 62.6 per cent. of the total.

Taking labour, water, and other charges *pro rata*, with a plant working to the above conditions, 37.4 per cent. of the steam raising cost should be charged to power generation and 62.6 per cent. to low-pressure heating. This proportion will, of course, vary with different plant, depending upon the pressures, and the curves A and B in fig. 1 have been drawn to illustrate this variation with boiler pressures of from 155 to 215 lb. per sq. in. absolute, assuming vacuum and feed temperature as above. From these it will be seen that the proportions do not vary very much, the range for power generation being only from 31 per cent. to 37.5 per cent.

In the case of reducing turbines it should be remembered that the vacuum is usually higher than that for reciprocating engines and, in addition, the steam is

invariably superheated. The effect of this is to slightly alter the proportions and the curves in fig. 2 have, therefore, been drawn for turbine plant for 28 in. Hg vacuum and 200 deg. F. superheat, the boiler pressures being taken from 175 to 265 lb. per sq. in. absolute and back pressures of 20 and 30 lb. per sq. in. absolute.

In this case it will be seen that the proportion chargeable to the engine room varies from 32.5 per cent. to 38.8 per cent., which is not very different from the previous case, so that, in general, reasonable figures to use are 37.5 per cent. and 62.5 per cent. for the proportions of steam-raising cost chargeable to power generation and low-pressure heating respectively.

In some instances it may be argued that it would not be possible to work up to the economical vacuum, and so the above figures would not hold. This is true, but it is an easy matter to determine the correct proportions and, in any case, they will not be found very different from the given figures, the engine-room figure increasing slightly with falling vacuum. To illustrate this, curve C, fig. 1, has been drawn for 20 lb. per sq. in. absolute back pressure and a 24-in. Hg vacuum, and it will be seen that there is only a 1.75 per cent. variation from the corresponding curve B for a 26-in. vacuum.

A HIGH-FREQUENCY INDUCTION FURNACE.

The Ajax-Northrup high-frequency induction furnace, which has been described in our pages in its earlier forms, is being developed by the Ajax Electrothermic Corporation in the United States, and particulars of a "Ten-inch conical pouring furnace" were given in *Chemical and Metallurgical Engineering*, Vol. 24, No. 7. Current for this furnace is supplied by a standard 20-kW converter set at about 15,000 cycles per second; this set is entirely static, and works with alternating current at 220 volts, 60 cycles, raising the pressure to 6,600 volts. The equipment comprises condensers, a transformer, and a discharge gap, by which the output can be regulated.

The furnace is shown in cross-section in fig. 1; it consists essentially of a crucible and a coil, with a small amount of electrical and heat insulation between them. The conical coil ranges in diameter from 4½ to 10½ in., and is 10½ in. high; it is made of 37 turns of ⅜-in. copper tubing, flattened and wound on edge, through which cooling water passes. Inside the coil is a layer of micanite about ¼ in. thick, and between this and the crucible is a ¼-in. space filled with a powdered heat insulator. The crucible holds from 50 to 60 lb. of metal of the density of steel, and will melt that weight of any metal of high specific resistance which melts under 1,200 deg.

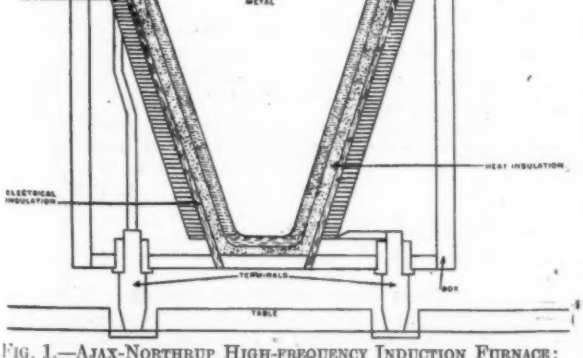


Fig. 1.—Ajax-Northrup High-frequency Induction Furnace; Vertical Section.

C. Metals which require higher temperatures are dealt with in smaller quantities. The metals are put into the crucible in the form of turnings or chips, but not fine powder. Owing to the addition of hysteresis to eddy currents, magnetic metals are heated with special facility. The molten metal is automatically stirred, rising high in the centre and descending at the circumference, under the action of electromagnetic forces. Very homogeneous alloys result, a matter of great value in many applications.

In pouring the melt, the crucible is lifted off the asbestos-board table on which it rests, and is then entirely disconnected from the electrical circuits. On replacing it, the terminals make contact with terminal plates sunk in the table top, as shown in the figure.

An actual test shows that 50 lb. of the metal of which castings for type-writer frames are made was melted in two hours 26 minutes with an average input of 17 kW. This metal is non-magnetic. Metals of high conductivity are not so readily dealt with in a crucible of non-conducting material; a crucible of moulded carbon or graphite is substituted, or fitted into the former, and the heat generated in the walls of the crucible melts the metal. A furnace of the size illustrated, with a carbon crucible, will melt 85 lb. of copper per hour.

Amongst the advantages claimed for this type of furnace are the following:—

The exterior is always at room temperature. As soon as the metal becomes molten it is actively stirred automatically.

Contaminating gases and carbon can be excluded from the metal.

The mass is heated uniformly throughout.

A temperature of 1,800 deg. C. may be attained.

Control of the temperature is perfect.

Crucibles for different metals can be inserted in the same furnace.

The component parts are readily interchangeable, but the essential parts suffer little wear, and the whole structure is simple and inexpensive.

INDUSTRIAL RESEARCH.

The Quarterly Progress Report recently issued by the British Electrical and Allied Research Association contains particulars of the scope and progress of several important researches which this body is carrying out.

Since the publication of the last report, work has been extended by the formation of new sections to deal with certain matters too big for subordinate classification. The work of the Joint Committee on *Dielectric Losses*, for instance, has so developed in extent as to demand independent treatment. The new Section to deal with this will conduct researches in the fundamental properties of insulating materials; immediate attention will be given to the question of thermal resistivity, on which but few experimental data are at present available.

Preliminary tests on *Fibrous Insulating Materials* (Section A) have revealed wide differences in the manufacture of both treated and untreated fabrics. These are under investigation, with the co-operation of manufacturers; at the same time the requirements of the users of treated fabrics are being considered as a basis for the purposes of standardisation. A similar policy is being pursued with treated papers. Specifications for fibres and boards are now drafted and under test prior to publication.

Work in Section B (*Composite Insulating Materials*), extending over twelve months, has emphasised the difficulty of dealing with materials of this class, owing to their wide variations in properties. The results of this work are now to hand, and methods for bringing them into perspective have been developed.

Of the extensive programme of research on *Insulating Porcelain* (Section C), based on preliminary researches by Messrs. Langton and Harris, much yet remains to be done. Included in this are researches on insulation resistance, improvement of surface, dielectric strength, and uniformity of vitrification.

Two reports by the Committee of Section D (*Mica*) are in course of preparation. The first is based on collected data on the use of mica and micanite for commutators; the abrasive hardness of these materials is, however, still under consideration. The second report deals with the use of mica in condensers.

Under Section E (*Insulating Oils*), a preliminary specification has been drawn up, and is in the hands of the British Engineering Standards Association for its consideration. There are extensive researches in hand on thermal transference coefficients, vapour pressure, thermal conductivity, and the action of catalysts. Samples of oils subjected to severe arc discharges in oil circuit-breakers have yielded data under the spectroscope and the ultramicroscope; these results will be valuable later in developing the research programme.

In Section F (*Conductors*), researches have included further tests on the heating of buried cables and tests on overhead wires. The results of the former are to hand, and will receive immediate consideration; other recent work on this subject, published elsewhere, is receiving attention. The tests on overhead wires have involved the provision of special apparatus for testing long lengths, under conditions corresponding to service conditions; this is now ready, and results are expected shortly.

The Committee of Section G (*Control Apparatus*) has been able to collect valuable data from power plant engineers and others. The voluminous material, collected from all sources, on the phenomena of switching and arcing, has required careful reconsideration before it could be reduced to a *résumé*, but new methods of attack have been developed as a result. Large scale tests, with the practical co-operation of power station engineers, have now been arranged. The Newcastle Electric Supply Co. has promised plant in the autumn for short-circuit tests on existing oil switches, and for the general study of the phenomena of circuit breaking.

Tests on *Mining Switchgear* have been arranged with the Home Office. These are to include studies of the magnitude

and relief of pressures set up by arcs in switch cases and by gas explosions. The Committee is also collecting data and samples of British standard ordinary-duty fusible cut-outs, preliminary to tests on heavy-duty fuses. Power plant engineers have been invited to co-operate in collecting data and in experimental work on d.c. circuit-breakers. A comprehensive programme of researches on the resistivity of joints and contracts is now in hand, and data are being obtained from existing plant showing results now obtainable under service conditions. Temperature rise is also under consideration.

The Committee on *Corrosion Researches* (Section H) is reviewing the phenomena of corrosion, with special reference to the corrosion of condensers.

Two new Committees (Sections J and K) have been set up since the publication of the last report. The first will deal with researches on turbines and turbine blading; it will co-operate with the Institution of Mechanical Engineers in the research on turbine nozzles being carried out at Manchester University. Section K will deal with the whole question of the manufacture of insulating materials with a synthetic resin base; special attention is being given to the production of these materials in this country.

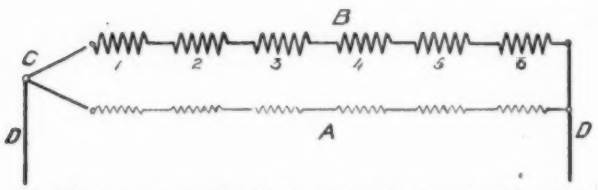
CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Motor Problem.

Would you or any of your readers kindly help me in the following case? :—

A few days ago I was called to see a small motor which has been erected to drive some cleaning machines in a shop. This motor has never worked since installed. I examined the system, and found it was a single-phase, 230-volt, 25-cycle supply. I then examined the motor, but could find no maker's name on it, and no output plate (absolutely no information). Next, I took the motor adrift, and found it was a single-phase, 0.5 h.p. one with two distinct windings, a running winding and a starting winding, each consisting of six coils. I reassembled everything, put fuses in, and started up. I found the rotor would rotate, but very slowly; and the motor took from 8 to 9 amps., so obviously I could leave current on but a short time, in case of burning the coils out. Now I thought it possible that some of the coils were wrongly connected, so I had the machine removed to my workshop. There I disconnected the coils and tested each separately, and found them perfect. I then traced the way they were connected



Squirrel-cage rotor; running winding consists of 6 coils, each coil occupying 4 slots; starting winding also consists of 6 coils, each occupying 2 slots. In the figure the currents circulates upwards in coils 1, 3, and 5, and downwards in 2, 4, and 6.

A = starting winding. B = running winding. C = starting switch. D D = supply mains.

and found them as shown in the accompanying diagram. The starting winding was purposely left disconnected, so I am dealing only with the running winding (being a small motor it can always be started by hand). The diagram shows the coils as they were originally connected; the current would produce poles N.S. N.S. N.S. (*i.e.*, assuming d.c. was passed through). Are these connections correct for single-phase motors? For the sake of experiment I have connected the coils up all sorts of ways imaginable, but with worse results than I obtained originally. Is it possible that this motor was designed to run on a 50 or 60-cycle system, or some circuit with a higher periodicity than 25? I may say I examined the rotor and found it correct. The bearings are of the ball-bearing type. How am I to get this motor working and on a 25-cycle supply?

D. T. Davies.

Porth, South Wales.
August 22nd, 1921.

The Electrical Trades Union and Non-union Labour.

With regard to "Fair Play's" letter in last week's issue, he states that the E.T.U. is flooded with all sorts of intruders, &c., and although not in the E.T.U. myself (I should be one of the so-called intruders, as I have never been apprenticed), I should be quite confident to back myself against any apprentice or improver of my age, where practical and theoretical d.c. work as a whole is concerned.

I may say that there seems to be more prejudice against a man who has not "served his time" than non-union men, but I feel sure that if a trade test were given before a man could join the union, there would still be men in it who had never been apprenticed.

As regards wiring, I have done at least a dozen installation jobs, on my own, and never quoted less than 33s. a point, when I know that union men, on their own, have been quoting from 15s. to 35s. a point; and I may add that I have not had a job turned down yet, nor any delay when putting in the supply, as they have other methods here of trying to squash non-union men who are canvassing for work.

L. H. Edwards.

Bristol.
August 20th, 1921.

Overhead Transmission Costs.

In your current issue you quote estimates made in the U.S.A. for three lengths of transmission lines for the New England Power Co.

6 miles cost £1,200 per mile.
9.5 miles cost £1,500 per mile.
21 miles cost £1,600 per mile.

If the original is accurately printed, there is only sufficient weight allowed in the six-mile line for one and a-half lengths of No. 2 B. & S. conductor; "19,800 lb. at 17 cents" being only half enough for the work specified.

The right of way is narrower, and insulators and telephone equipment cheaper per mile.

In the *Electrical World*, May 7th, 1921, p. 1,048, Mr. Ashworth, engineer, Utah P. & L. Co., criticised the absence from the estimates of the New England Power Co. of any expense for surveying for a line which involved very considerable expense for clearing a right of way. These errors are worthy of correction.

Theodore Stevens.

London.
August 24th, 1921.

Carpets and the Electric Suction Cleaner.

If a "last word" is permissible as a comment on the correspondence evoked by the recent article on "Carpets and Vacuum Cleaners," may I ask why so much emphasis is laid by the correspondents on the necessity for powerful suction?

Do the manufacturers of vacuum cleaners imply that the carpets and rugs in an ordinary everyday household have in the past been allowed to get into such a condition of dirt and grime that they need really drastic treatment to clean them? or do they anticipate only a "spring-cleaning" use of the vacuum cleaner? In either of these cases powerful suction would be necessary, but since most women buy vacuum cleaners with the idea of using them at least once a week, the stress might with advantage be laid on simple construction and easy manipulation rather than on powerful suction.

Mary Gwynne Howell.

London, S.W.,
August 29th, 1921.

Accumulator Froth.

In answer to "Curious" in your issue of August 26th, I should like to point out that "frothing" only occurs in accumulators by certain makers. In a nut-shell, the reason is inferior quality celluloid.

As a manufacturer for the past 12 years of celluloid cases, and also of the complete accumulator, I can truthfully say that I have never seen or heard of one of my make frothing.

A. E. Frost.

London, N.
August 29th, 1921.

Trade Terms and Direct Trading.

It has come to my knowledge that private firms are receiving as favourable terms (*re* lamps) as the contractors, who are tied down by certain rules of the E.L.M.A. with regard to retail prices, and also what make of lamp to sell, and I think it is unfair for private customers to be able to inform me that they can get better terms from the manufacturers than we contractors can give them.

I should like the opinion of other contractors on this matter. I myself have had large orders cancelled through customers of mine getting better terms from the E.L.M.A.

I think it is time that contractors took this matter up. I also think that all "ring" lamps should be ordered through local contractors.

If this unfair business continues I shall be obliged to push the imported lamp.

Half What?

August 24th, 1921.

Country House Lighting Sets.

An article on "Automatic Lighting Sets" is long overdue, and the contribution of Mr. H. R. Taunton is acceptable. At the same time, it is a pity Mr. Taunton has dealt with this admittedly important development in rather incomplete fashion; certainly one is afraid that "in sailing through the Straits of Messina," so to speak, there is trouble both at Scylla and at Charybdis!

In dealing with the various points Mr. Taunton raises, it may, in the first place, be said that, so far as the number of seriously competing lighting plants is concerned, these amount to some 30-odd makes, a list of which is enclosed for information. The case of the full-automatic set is clearly stated, but one may question if damnation has not been ladled out excessively. Certainly this class of plant may be expected to improve in construction and performance in the course of time, though the difficulties are obvious. Even so, it is likely that semi-automatic sets will always hold the market in this line of business, for precisely the reasons Mr. Taunton sets forward in his third from last paragraph. With regard to the size of these plants, ¾ kW is not the favourite size, this being 1 kW, or over.

By anyone engaged in this business—and one supposes this to include practically all electrical contractors—the plant so enthusiastically described by Mr. Taunton will be at once recognised, and while, on patriotic grounds, no one can cavil at the support given to any British plant, yet, on general technical and commercial grounds, there is much to be said for many non-British plants. Mr. Taunton's remark to the effect that "the average Englishman likes plenty of metal for his money, even if this results in a white elephant," is hardly flattering to the average Englishman; and it "a widely advertised American set, which has a cylinder of the size of a half-pint tumbler, and can deal with 50-light installations," meets buyers' requirements, and a very large number of such equipments are sold, then the case appears to be one where the proof of the pudding is in the eating thereof, and there would appear to be evidence that the average Englishman seeks "performance" first and "scrap-iron" value at a later date. Above all, Mr. Taunton's remark that the average American set is built for only a short period of service is to be seriously challenged, and one would be glad of a detailed statement. It may also be said that one British lighting-plant manufacturer is known to have recently turned out three different models in almost as many months.

As regards the matter of American batteries, one can hardly agree with Mr. Taunton's conclusion so far as the question of "standard" is concerned. The fact that British makers rate their batteries differently to the Americans, and that, in consequence, there is some degree of reserve in the case of the British battery is, of course, to the advantage of the purchaser, but this does not necessarily imply faulty description on the part of the American makers. In any event, Mr. Taunton's remark as to certain of such batteries being rated on "ignition capacity" can, one believes, be suitably ignored. The whole situation here appears to be one for battery makers' own consideration when viewing the competition they are meeting.

Turning to the question of 32-volt accessories, experience goes to show that these are not too difficult to obtain, and a list of such suppliers can be furnished if necessary. To secure 25- or 50-volt apparatus seems more difficult. With regard to lamps, Association firms are supplying them, and no shortage has been known to the present day. The point of low voltage entailing increased wiring cost is hardly to be taken seriously, unless comparison is made with standard systems of 110 volts and upwards. As against any such increase in cost, the fact that 32-volt systems or thereabouts are infinitely safer to the public, in the way of freedom from shock and general safety, cannot be ignored. Also, 16-cell batteries are about the limit so far as the question of voltage drop from "full charge" to an "empty" is concerned, and the connecting of such a battery as a "block" without end-cells, makes the simplest form of equipment for non-technical owners to handle.

In the case of the "Ford-Rolls-Royce" comparison mentioned by Mr. Taunton, the position is not at all clear. In the first place, such small sets are intended primarily for generating electricity and not for driving saws, churns, cutters, &c., direct. To drive such appliances from the generating set itself is poor engineering practice; moreover, it is more often than not a very difficult matter to reconcile the best position for the generating set with that most suitable for pumping or the driving of the farm appliances in question. Again, every country resident does not have accessories grouped together, and considerable lengths of line shafting would be required under such a scheme. Far better is it to have separate motors or a portable motor, though, of course, this increases the cost of the installation. It is also to be observed that farm appliances are not constantly in use, so that a material wastage of power is likely to result in adopting the system mentioned by Mr. Taunton.

With regard to Mr. Taunton's penultimate paragraph as to the ideal set, it may be said that under (*a*) there is such a set on the market, (*b*) ditto, (*c*) a simple, though expensive, matter to safely arrange. At the same time, the question of leaving any set to its own devices for months at a time is too exaggerated for consideration; moreover, one questions whether this is required. Mr. Taunton appears to forget that a reasonable amount of "service" is implied and is included in the sale of these plants. Experience goes to show that for the first two months or so the average country owner takes great care in maintaining; during the second two or three months rather less attention is given to the equipment; finally many owners appear to decide that the plant needs no further care in a general way. This is really the "secret" of the semi-automatic plant, as it calls for human attention at regular intervals, and the equipment benefits accordingly. If the plant is not properly maintained and periodically inspected trouble is bound to develop with even the best of sets, whether they be full- or semi-automatic.

Mr. Atkinson's letter on this subject in your issue of August 19th may also be referred to, and here there is evidently a misconception. In the course of selling well over 1,200 plants of this description, it has been found that the average installation is certainly not more than about 40 lights, with a little power load, such as iron, sweeper, fire-log sawing, churning, and possibly some pumping duty. In fact, it is for a recognised average duty that the particular lighting plant with which the writer is connected is specially built. One agrees that the average owner often adds to his installation in the course of time, but not to the extent implied by Mr. Atkinson—in fact, only two cases are known where the plant was overloaded, one being an error at the commencement and the other a case where it was recognised as being a temporary measure till a larger plant on order was obtained. For large establishments, institutions, &c., it is the practice to install two, three, or more plants, which may be worked in parallel or separately. A number of such installations are actually in existence.

With regard to the point Mr. Atkinson raises as to whether semi-automatic sets have been installed for a sufficient number of years for a satisfactory estimate of their reliability to be formed, it may be said that such plants have been on the market for at least the past ten years, and that there is a real history behind this development; moreover, one looks for considerable future development in this particular line of industry.

Marshall Tate.

London, W.C.
August 24th, 1921.

The E.P.E.A. Schedule and Economy Stunts.

What good does Mr. Jones hope to achieve by rattling the sabre?

If he imagines he can maintain the drooping spirits of his Association and, likewise, ensure a steady flow of subscriptions by shouting "We whacked 'em at Dover and Perth,"—Well good luck to him.

But has he won? Did he win at Stalybridge? When reading his bragging letter, one is forced to the conviction that the victory he is so bombastic about is merely of an evanescent nature, and soon things will find their own level.

There is the law of Supply and Demand, which will dictate to Mr. Jones what schedule he must adopt, even as it has done to the miners.

As to all that piffle of "resisting by every means in its power," what is power in the commercial sense? It is money, and the power of any trade union is the measure of its solvency.

If the E.P.E.A. called all its members out to-morrow (that is, supposing they all came out!!!), the E.P.E.A. would be "busted" financially, and its members glad to get back as volt boys, and Mr. Jones knows it. That is why he shouts Dover! Perth!—Beware!

If unions like the A.E.U. of many years' standing, and backed up by powerful finances, accept reductions as a logical consequence, it should be evident to Mr. Jones that sooner or later his weak Association must be submerged by powerful municipalities.

There are always plenty of good engineers ready to fill a station at a low wage, hundreds in fact. There are many engineers, chief assistants among others, who threatened to plunge towns into darkness not so very long ago. What is their position to-day? The various committees have granted their demands temporarily, but they hold them in such disgust and contempt, that when the chief's post becomes vacant, they will be passed over, and dismissed on the first opportunity, and they have to thank their indefatigable secretary for landing them in such a hole.

Anti Bunkum.

August 27th, 1921.

Foreign Competition.

The wails of the British manufacturer at the sad sight of contracts going abroad are particularly interesting when one studies his terrific energy in going after business offered him.

My firm advertised in the Review a week or two ago for starters for single-phase motors that it wishes to run in conjunction with its machines, and for which it does not want to pay fancy prices.

Net result: three replies from foreigners and one offer of second-hand oil switches from an English firm.

W. A. C. Philpot.

London.
August 26th, 1921.

Oil Consumption and Prices.

I have held over my reply to Mr. S. H. Fowles's letter in your issue of August 12th, until I had an opportunity of hearing from the engineer in question. He sends me the following:—

Capacity of alternator 1,000 kW.
Total running hours=98.6 per cent. of possible per annum.
Energy supplied, exclusive of station auxiliaries, 2,666,000 units for year 1920.
Temperature of bearings of turbo. set, 148/150 deg. F.
Lubricating oil used per annum for turbo. and auxiliaries, 350 gallons.

No attempt is made to attain economy records as regards oil consumption. The safety of the collieries depends upon the electrical plant, therefore reliability and continuity of service is more desirable than the saving of lubricating oil. No old or filtered oil is used in connection with the plant, all reclaimed oil is used for the rough machinery outside the station. The oil cabinets are under the care of the power station attendants, and oil is not doled out to them.

In addition to oil, 28 lb. of grease lubricant are used per annum for the circulating pump thrust bearing. This constitutes, with the oil, the whole of the lubricant used.

Mr. Fowles inquires how the 1,000-kW set can show a lower oil consumption than the 48,000-kW station. In this instance it is done by Mr. Fowles assuming that the turbine in question runs at full load for 98 per cent. of the time. As the number of kWh generated is now given, he will be able to correct his figures, and will obtain a value of about 0.00013 gal. per kWh generated. This figure, dealing as it does with a station using only new oil, is of interest as it shows up clearly the economies which Mr. Fowles has succeeded in obtaining.

I am obliged to him for calling my attention to the article on fuel and costs in *Gas and Oil Power*, and also wish to thank Messrs. G. B. Petter and Robert Scott for their useful contributions to the discussion.

E. F. Butler.

London,
August 27th, 1921.

Testing and Repairing Magnetos.

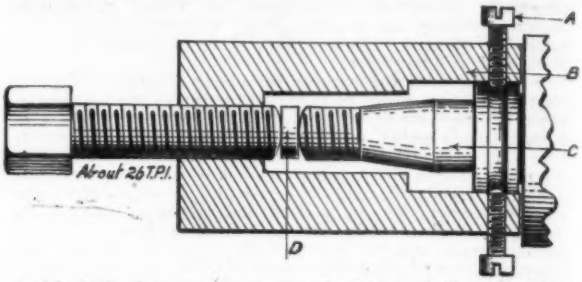
Having followed with interest the letters under the above heading that have appeared in your recent issues, and as part answer to "Mag's" letter in your issue of August 26th, we should like to state that we have had a race puller in use in our workshop for a considerable period.

That this pattern is infallible we can guarantee, and if it is a "trade secret," then we can only imagine that that portion of the trade who do not know its construction, must be lacking in ingenuity, as it resembles in principle the well-known wheel puller.

We enclose a sketch for the benefit of interested readers, and may add that the only "secret" embodied is that the bore must exactly fit the walls of the inner race, otherwise it is impossible to obtain screws sufficiently strong to withstand the strain to which they are subjected.

We may add that this puller has never yet failed us except on a starting motor with a very long shaft, and in this case it is cheaper from a business point of view to crack the inner race (not by the Service method), and replace.

We have had difficulty at times in removing an outer thrust race, as we find that some of these, instead of being a fit, in the mechanical sense of the word, have apparently been forced home with something akin to a hydraulic press.



A, eight hardened steel screws; B, piece of mild steel shafting; C, magneto spindle; D, brass or copper buffer.

BALL RACE PULLER.
(Not to scale.)

We should be pleased to hear of a simple method of testing a condenser *in situ* and without disconnection of the primary which is, of course, virtually, in shunt.

Taylor & Briggs.

Derby,
August 27th, 1921.

LEGAL.

EMBEZZLEMENT OF "OUTING" FUNDS.

AT Ealing Police Court on August 24th, Ernest Mowbray Walker, described as an electrical engineer, was charged with having embezzled the sum of £500, this being money deposited with him on account of contributions to an "Outing Fund" by employés of the Underground Railways. A police officer, giving evidence, said that prisoner rang him up and told him that he (prisoner) had used the money, and asked to be arrested. The defendant said that he had given part of the money to friends and had squandered the remainder. He thought that he might be able to get some of the money back. He was remanded on bail.

TRAMCAR DRIVER ASSAULTED.

AT the Bolton Police Court last week, Jas. O'Donnell, Howe Bridge, Geo. Smith, Westleigh, and Edward Heaton, Westhoughton, were summoned for assaulting a tramcar driver with the object of taking the car beyond its destination late one evening.

The magistrates considered it a very serious offence to attack a public official whilst executing his duty, and fined the defendants the maximum penalty of £5, and ordered them to pay £1 costs.

BUSINESS NOTES.

Bankruptcy Proceedings.—T. HYDE, electrician, 180, London Road, Croydon.—The first meeting of creditors was held on August 26th at 132, York Road, S.E. 1. The statement of affairs showed liabilities £635, while assets were estimated to realise £172, from which £30 had to be deducted in respect of preferential claims, leaving net assets of £142, or a deficiency of £494. Debtor attributed his position to losses in trading consequent upon general trade depression, loss of staff, and restrictions relating to light and heating during the war. It appeared that he commenced business in 1895 at his present address with £50 capital. In 1904 he added the business of an electrical engineer. Until 1911 his takings averaged about £800 a year, but they subsequently decreased. Early in 1914 he realised that his profits were not sufficient to cover his household and personal expenses. From 1916 no profits were earned and debtor had since been subjected to pressure by his creditors. At the date of the receiving order four creditors for about £207 had obtained judgments against him, and an execution having been levied on his effects, he filed his petition. The only book of account produced was one containing records of his transactions with his credit customers. He became aware of his position in 1914. The case being a summary one, the matter was left with the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
A. Turner & Co.	39	Heath & Co.	6
Edison Swan, Ltd.	174	C. Johnson	5
General Electric Co.	20	Stella Lamp Co.	5
W. Hall	25	Whitworth Lamp Co.	8
A. Taylor	150	Bankers	95
Baxter & Caunter	5	Mrs. Davies	100

A. C. A. WAMPACH, electrical engineer, Formby Lodge, Seabrook Road, Hythe.—Last day for proofs for dividend September 10th. Trustee, Mr. J. O. Morris, Official Receiver's Office, 68a, Castle Street, Canterbury.

A. R. MEGGETT, electrical engineer, 45, Thrumpton Lane, East Retford. First and final dividend of 5s. 9d. in the £, payable at the Official Receiver's Office, Lincoln.

Company Liquidations.—HUDSON'S ELECTRICAL ENGINEERING CO., LTD.—A meeting of creditors was held in Leeds on August 29th, when the following statement of affairs was submitted: Liabilities £5,642; net assets £2,056; deficiency, as regards creditors, £3,586; share capital issued £1,000. The net assets represent approximately 7s. 3½d. in the £ on the claims to unsecured creditors. The total deficiency of £4,586 is accounted for by the loss on trading, depreciation in stock-in-trade, motor lorry, fixtures and fittings, goodwill, and preliminary expenses written off, reserve on book debts, and a very heavy discount on a debenture taken in satisfaction of a trading debt. It was decided to appoint a committee of inspection to confer with and advise the liquidator appointed by the company in the voluntary liquidation and to investigate the statement of affairs and general position of the company.

ARC & GENERAL EQUIPMENT, LTD.—Winding up voluntarily. Liquidator, Mr. F. A. Gillies, 37, Brown Street, Manchester. Meeting of creditors, September 5th, at Manchester.

MALAGA ELECTRICITY CO., LTD.—Winding-up voluntarily. Liquidator, Mr. F. C. Allwork, 39, Coleman Street, E.C.2. Meeting of creditors, September 15th.

Trade Announcements.—The Ateliers de Constructions Electriques de Charleroi has now opened its own offices at 56, Victoria Street, London, S.W. 1, under the management of Mr. John H. Bunting, who will handle the whole of the company's British and Colonial business. The various works of the A.C.E.C. are all located within Belgian territory which was occupied by the enemy throughout the war, and owing to the company's anti-German attitude, the works were taken over and were used exclusively for German purposes for more than two years before the armistice. The Germans removed the company's machinery and equipment, which, after the cessation of hostilities, had to be recovered, repaired, and in many cases renewed or replaced, before the firm was in a position to resume its normal pre-war activities. We understand that the company is to-day the largest electrical manufacturing concern in Belgium, that it employs nearly 5,000 people, and that it is in a better position than ever before to supply all classes of electrical machinery, La Cour motor converters, rotary converters, turbo-alternators, transformers, switchgear, electric winders, pumps, traction equipment, cranes, railway signalling apparatus, and paper and rubber insulated cables.

The Jackson Electric Stove Co., Ltd., has appointed as its agent for the whole of Scotland Mr. H. L. Kirby Johnson, of 68, Gordon Road, Glasgow. A range of samples and small stocks will be held at this address for Scottish clients. It has also appointed as its agent for the Midlands Mr. Kenneth Hoggan, of Needless Alley, New Street, Birmingham. He likewise will hold a range of samples and small stocks.

Mr. C. B. Maurice has joined the board of directors of Messrs. Catchpole & Maurice, Ltd., whilst continuing to act as the London agent for Messrs. Cranmore & Co., Ltd., Birmingham, and Messrs. W. H. Cheadle & Waltho, Ltd., Wolverhampton; the address is Albion House, 59-61, New Oxford Street, W.C. 1. Telephone: Museum 3942.

Messrs. Harwell, Ltd., of 2, Bayley Street, Tottenham Court Road, London, W.C. 1, inform us they are the sole agents in this country for the "Usines Diélectriques," Delle, Territoire de Belfort, France, manufacturers of micanite, amberite, oil silk, paper and sheets, tapes and cloths, all classes of insulating varnishes, and also commutator rings, presspahn and bakelite material.

The London Electric Firm, Brighton Road, Croydon, informs us that the telephone number for its stall and exhibit at the Shipping Exhibition at Olympia will be Hammersmith 2148.

Messrs. Charles Churchill & Co., of Leonard Street, London, E.C., have been recently appointed sole agents for Great Britain for the National Acme Company, of Cleveland, Ohio, U.S.A., which manufactures Grindley automatics, Acme automatics, and numerous auxiliary machines. This department is under the supervision of Mr. C. W. Simpson at Manchester. He has for many years been associated with the Gridley and Acme products. A stock of spare parts will be held.

Messrs. Baxendale & Co., Ltd., 3, St. Andrew's Square, Edinburgh, have removed to Grassmarket, Edinburgh. The telephone numbers remain the same.

Catalogues and Lists.—Messrs. Aland & Co., 203, Great Dover Street, S.E. 1.—List No. 45, giving illustrated details and prices of exhausters and blowers of widely varying sizes.

The Dussek Bitumen Co., Empress Wharf, Bromley-by-Bow, E. 3.—An illustrated treatise upon the manufactures of the electrical department, dealing principally with "Trinidite" joint-box compound.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, E.C. 2.—A blotter advertising "Henley" "sticky" tape; also List W.L. 2, an illustrated and priced catalogue of "Isco" loop-in cut-outs for house services.

Messrs. J. A. Crabtree & Co., Ltd., Rushall Street, Walsall.—A number of illustrated and priced leaflets dealing with "Crabtree" quick "make" and "break" switches.

Messrs. A. Fort & Co., 51, Whitfield Street, Tottenham Court Road, W. 1.—An illustrated and priced catalogue of electrically-driven gramophones in various styles and periods.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4.—An illustrated and priced leaflet describing "X-ray Scoopette" fittings for show-case and window lighting.

The Falkirk Iron Co., Ltd., Falkirk.—Leaflet No. 261, dealing with the "Falco" electric wash boiler. Illustrated and priced.

The Edison Swan Electric Co., Ltd., Ponders End, Middlesex.—List No. W.W. 232, an illustrated and priced publication dealing very fully with the "Ediswan" house wiring system described in our issue of July 22nd last.

Messrs. Herbert Morris, Ltd., Loughborough.—Book 97, illustrating and describing hand-operated cranes.

Mr. George Ellison, Perry Barr, Birmingham.—List No. 330 (76 pp.), giving very full particulars and diagrams of drum type motor control gear (hand-operated) for d.c. and a.c. working.

The Key Engineering Co., Ltd., 4, Queen Victoria Street, E.C. 4.—A well-illustrated booklet dealing with "Key" fibre conduit and troughing, giving views of installations and particulars of tests.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Monthly Magazine, Vol. III, No. 6, September, 1921, containing stock lists of a.c. and d.c. motors, d.c. dynamos, notes on starting gear, and humorous items.

Messrs. Phillips & Turner, 115, Edmund Street, Birmingham.—Three illustrated lists of ceiling fittings, including plates, bowl rings, and chains.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C. 4.—A set of five booklets giving "Hints on Working Aluminium." A great deal of valuable information of a varied nature is contained in these booklets. They deal respectively with: "Aluminium Ingots," "Sheet," "Circles," "Tubes," and "Sections." Tables of weights, sizes, &c., are embodied in the publications.

The "Attracta" Electrical Co., 11, Hanway Place, W. 1.—An illustrated pamphlet dealing with a wide selection of electrical signs. Priced.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—September 7th to 28th, Shipping, Engineering and Machinery Exhibition; September 12th to 16th, International Dental Exhibition; October 14th to 22nd, Commercial Motor Exhibition; November 4th to 12th, Passenger Motor Exhibition; November 17th to 25th, Public Works, Roads and Transport Exhibition; March 1st to 25th, 1922, Ideal Home Exhibition.

Cardiff.—May to October, 1922, Welsh National Exhibition.

Glasgow.—September 19th to October 8th, Ideal Home Exhibition; November 1st to 19th, Shipbuilding, Engineering, and Electrical Exhibition.

Belgium (*Brussels*).—April, 1922, Commercial Fair.

France (*Lyons*).—October 1st to 15th, Metallurgy, Machinery, and Industrial Fair. (*Paris*).—November 12th to 27th, International Aviation Exhibition; March 1st to 15th, 1922, Spring Fair.

Rumania (*Bukarest*).—Samples Fair and Rumanian Exhibition.

Spain (*Barcelona*).—March 15th to 25th, 1922, Samples Fair.

United States (*New York*).—January 15th to 25th, 1922, General Merchandise Fair.

A *Reuter* message states that the International Samples Fair which was to have been held in Trieste this month has been postponed until next year.

The Welsh National Exhibition.—We have received from the secretary of the above exhibition, 4, Mount Stuart Square, Cardiff, a copy of an advance prospectus. Mr. Lloyd George has accepted the presidency of the exhibition, which is to be of ambitious proportions, covering an area of 60 or 70 acres. The names of many representative Welshmen appear in the list of officers and committee. The exhibition is to be arranged in seven sections: Education, mining, health, housing, agriculture, fine art, history, and music. It is stated that ample provision will be made for the supply of power for exhibits of machinery in motion and for lighting, and no profit will be made from this source. Machinery will play a prominent part in the exposition.

For Sale.—Assets Auctions Co., Ltd., will sell by auction on September 7th, at 119-121, Newington Causeway, S.E., electrical stores, including fuseboards, switches, cable, wire, &c.

By direction of the Disposal and Liquidation Commission, Messrs. Fuller, Horsey, Sons & Cassell will sell by auction on September 6th, at the Military Railway Wharf, Purfleet, plant and machinery including electric generating sets, motors, &c., and on September 20th, chemical plant and machinery at the Grilo-oleum Works, East Greenwich, S.E.; on September 14th, 15th, and 16th, at the Central Stores Depot, No. 83, Georgetown, near Glasgow, Mr. H. Marshall will offer by auction engineering and electrical plant, machine tools, &c., for particulars, &c. (See our advertisement pages to-day.)

According to a Central News correspondent, the Disposal Board has decided to put up for sale within the next fortnight the huge stocks of machine tools and electric plant which are lying at the munition towns of Gretna, Georgetown, and Irvine, and at the experimental station on the Gareloch, valued at some millions sterling.

Copper and Lead Prices.—Messrs. F. Smith & Co. report. August 30th.—Copper (electrolytic) bars, £72 10s., 10s. decrease; electrolytic sheets, no change; electrolytic wire rods, £88, 20s. decrease; ditto H.C. wire 11¼d., 1/16d. decrease.

Messrs. James & Shakespeare report, August 31st.—Copper bars (best selected), ditto sheet, ditto rod, no change; English pig lead, no change.

Battery Contracts.—Edinburgh Corporation has placed an order with Messrs. Pritchett & Gold and E.P.S. Co., Ltd., for two batteries, each consisting of 120 cells having a capacity of 2,640 ampere-hours at the 10-hour rate of discharge. These batteries will be installed at the new power station which the Corporation is putting down at Westbank, Portobello, and will be able to supply 500 kW for three-quarters of an hour in an emergency.

In 1900 Messrs. Pritchetts & Gold supplied a battery to the Macdonald Road station of the Edinburgh Corporation, and this battery is still giving useful service.

The New Spanish Tariff.—The British Chamber of Commerce for Spain has called attention to the new Spanish Customs tariff, which imposes a duty on 1,425 articles compared with 718 in the old tariff, and urges that manufacturers and others should lose no time in petitioning against the tariff, the latest date for doing which is September 8th.

Industrial Conciliation.—"It is largely because of the mutual growing respect of the two sides of industry that recent wage cuts have been accompanied by so few strikes," declared Mr. A. H. Paterson, general secretary of the National Alliance of Employers and Employed, in a recent interview. During July, he pointed out, there were 94 industrial disputes, compared with 265 in the corresponding month of last year, and reports received by the National Alliance showed that the spirit of goodwill and conciliation was becoming more manifest in industry. "There is," he added, "a growing sense of sympathy, of understanding, and of the desire to understand by a large number on both sides. Now is the time, while there is an atmosphere of sympathy and understanding, for leaders of trade unionism and of employers to join together to concert preventive measures against future strife. Good trade brings strikes or threats of strikes. Get the right feeling now, and when a boom comes in a particular trade employers will be able to make it clear that their first thought is of benefiting their workers. The moment you move first towards giving workers the advantage of increased prosperity you kill strikes."—*Daily Telegraph*.

Book Notices.—"The Decimal Educator," Vol. IV, No. 13, September, 1921. London: The Decimal Association. Price 6d.—In addition to the secretary's quarterly report, and included among a number of useful and interesting notes, is a reprinted article on "The Metric System in an American Workshop," by Theodore H. Miller. The author's experience of twelve years of the metric system is that it is an economical measure, reducing the number of errors in interpreting drawings and in making calculations.

"The Indian Importer and Exporter," Vol. I, No. 1. August, 1921 (80 pp.). London: The Pioneer and Civil and Military Gazette, Ltd. Monthly, 10s. per annum, post free.—This new journal will prove a valuable aid to those engaged in general trade with India, as it deals with many important and varied subjects.

"Science Abstracts," Vol. XXIV, Part 7, Sections A "Physics," and B "Electrical Engineering." London: E. and F. N. Spon, Ltd. Price 2s. 6d. per section.

Reported German Commercial Intrigues in Italy.—A Rome paper has published a report, said to have been sent to the German Government by the Commercial Attaché at the German Embassy in Rome, which lays stress on the German effort after the Armistice to recapture the Italian markets from France, Great Britain and the United States. In order to create a political atmosphere favourable to Germany the report suggests the exploiting of the discontent of the Italian people with the Entente Powers, and says it is necessary to aggravate this discontent by economic action. "With this object," the report continues, "we must establish economic ties and interests with Italy, such as will compel her always to support our policy. Above all, it is necesary to organise a systematic export service of German goods into Italy, and even at a lower cost than that of production. We shall thus gain the sympathy of the Italian consumer, and at the same time render it impossible for Italian industry to continue its activities. A crisis will thus be brought about which will leave Italy in the throes of constant agitation, and make us the master of commerce in the peninsula. It will also allow us to buy up Italian concerns at very low prices.

The report proceeds to point out how German industry can be developed in Italy by taking over various Italian concerns. It shows how the Siemens firm is endeavouring to absorb the Fiat Company by a Stinnes-Fiat combine, and by the acquisition by the Deutsche Bank, which it says is interested in Siemens, of shares in possession of the Banca Commerciale Italiana.

The alleged report next speaks of the necessity of preventing Italy from securing a privileged position in Jugoslavia and the East, and announces that steps have been taken to secure German participation in certain Italian firms, and for the return by Italy of vessels of the German Levant Line.

"The products of the Allgemeine Electricitaets Gesellschaft," continues the alleged report, "have killed the manufacture of electrical plant in Italy, but the German firms must understand the necessity for their branches to be known under Italian names."

The Consortium of Chemical Products of Berlin, the Deutsche Bank and the Disconto Gesellschaft have opened negotiations with Italian groups.

The report concludes by urging that the German-Italian Union shall constantly make its influence felt, and that an Information Office shall be established at the German Consulate in Milan to report on the industrial situation, and to add to the difficulties in labour troubles.

The German Embassy at Rome has emphatically denied that such a report was made. The *Idea Nazionale*, however, says it has sure proof of the authenticity of the document.—*Reuter's Trade Service* (Rome).

A Switch's Action "Filmed."—To enable the action of their quick "make" and "break" tumbler switches to be studied, Messrs. J. A. Crabtree & Co., Ltd., Walsall, have recently had a switch photographed by an "ultra-rapid" kinema camera. The film was taken at a speed of 200 exposures per second, the actual period of each exposure being .0011 sec. The throw-over of the switch was so rapid that there was only one exposure between the commencement of the movement and complete contact.

Electrical Demonstration at Bournemouth.—Referring to the note in our last issue, Mr. E. Brontman, of 139, Bournemouth Road, Parkstone, who is organising the demonstration that is to take place next month, informs us that there is still room for further exhibits, and he invites manufacturers and wholesale firms to participate. According to the local Press, his electrical showrooms contain an extraordinary variety of devices for use in the all-electric home.

Trade with Denmark.—It is reported that a large party of Danish electrical experts will visit this country during September, and make a tour of British works.

Cricket Match.—In a cricket match between teams representing the Barrow-in-Furness Corporation tramway men and the local police, last week, the tramway men badly beat the guardians of law and order, scoring 84 runs against the meagre score of 18 by the police.

Power House Equipment Required for Canada.—The Department of Overseas Trade is informed that a power house is to be erected for the Normal School and Institute of Technology, Calgary, Canada, and it is proposed to install a steam-driven generating plant. The boilers have been already purchased, but specifications for the remainder of the plant are not yet prepared. British firms interested should send literature, &c., to the Provincial Architect, Department of Public Works, Alberta.

Stoker Contracts.—Among the contracts recently carried out by Messrs. E. Bennis & Co., Ltd., are the following for electricity works:—

Wallasey Borough electricity station, Liscard.—Relinking two Babcock & Wilcox chain grates.

Peterborough Corporation electricity works (per Spearing Boiler Co., Ltd.).—Two chain grate stokers for Spearing water-tube boilers.

Cardiff Corporation Electricity Department, Roath power station.—One complete ash-handling plant.

The general contracts include coal and ash-handling plant for mills at Warsaw, and sprinkler stokers and compressed-air furnaces for shipment to Japan.

The Kiewa Hydro-electric Scheme.—His Majesty's Trade Commissioner in Australia (Mr. S. W. B. McGregor) has forwarded a copy of the Report on the Kiewa Hydro-electric Scheme by the Electricity Commissioners of Victoria, which includes the report and estimates of the scheme by Mr. A. G. M. Nichell, M.C.B., their consulting hydraulic engineer. The reports may be consulted by United Kingdom firms interested on application at the Inquiry Room of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1.

Henley's Wiring System.—Correction.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., ask us to correct an error which they made in their advertisement in our issue of August 26th, in that they referred to Witley Court as "recently the seat of the Earl of Durham," when in fact the reference should have been to the Earl of Dudley. This mansion, which was illustrated, was for over 300 years the seat of the Earls of Dudley, but last year it was acquired by Sir Herbert Smith.

Annual Outings.—The first annual outing of Penrose Lifts, Ltd., formerly the lift department of Messrs. A. W. Penrose & Co., Ltd., was held on Saturday, August 20th. The party journeyed by road to Brighton, and lunch was served at the Devon Restaurant. The toast of "The Firm" was proposed by Mr. W. E. Johnson, who said that most of the employés who were transferred from the old company had a sentimental attachment to the Penrose Lift, and had confidence that the new firm would have a successful future. Mr. F. E. S. Lindley, in replying, said that the difficult times had been got through so far successfully, and the difficulties would disappear in the near future.

The offices and works of Messrs. J. H. Tucker & Co., Ltd., Birmingham, will be closed on Saturday, September 3rd, for the annual outing.

Chemical Industry Wages.—As a result of the conciliation efforts of the Ministry of Labour at Manchester on August 26th, the threatened stoppage of work in the chemical industry was averted, and the notices were withdrawn. It is understood that the terms of settlement provide for 1½d. reduction from August 1st, with another reduction of ½d. per hour from October 1st, as against 2d. per hour proposed. The settlement also provides for the stabilisation of wages until the end of the year.—*Daily Telegraph*.

Swiss Production.—The Dutch Consul at Zurich reports that Swiss glow lamp makers and electrical contractors complain of an increasing scarcity of orders, and makers of porcelain for electrical purposes have been compelled further to reduce their production.

Proposed Amalgamation of Transport and General Workers.—The Executive Council of the National Transport Workers' Federation has passed a resolution welcoming the scheme of a Transport and General Workers' Union, and urges all the unions affected to consider the necessity of strengthening the Labour movement by a further consolidation of forces inside the new organisation. The executive is to instruct a special sub-committee to open negotiations with the executive committees of the affiliated unions to consider all necessary means of securing the best and strongest organisation of the men employed in all forms of transport.—*The Times*.

Australian System of Surtaxes.—It is reported that the Australian Parliament is considering the adoption of a system of surtaxes to be levied on goods coming from countries where the rate of exchange is low, on the ground that these countries —France, for example—pay their workers in depreciated money, and can consequently produce at a cheaper rate than can Australian firms. The *Journée Industrielle* understands that the nations interested will protest against the allegation on which the Bill is based.—*Reuter's Trade Service* (Paris).

The Rumanian Market.—Rumania offers a market for British goods in very many lines, states the Commercial Secretary to H.M. Legation at Bucharest in his recent report on the economic conditions in Rumania. The following are among those of most importance: Electric dynamos and motors, fans, lamps, &c., gas and oil engines, pumps, iron pipes and tubes, belting, and rubber goods (machinery).

Social.—On Saturday, August 20th, the chairman and directors of MESSRS. RAWLINGS BROS., LTD., and the RAWLPLUG CO., LTD., gave a garden party and fête to the members of their staff. The opportunity was taken to present a silver salver and other presents to Mr. and Mrs. J. J. Rawlings as mementos of their silver wedding. The directors also made presents to employés of 20 years' standing. Sports were held during the afternoon in which a large number of people took part; prizes were presented to the winners by the donor, Mr. J. J. Rawlings. There were several amusing side shows run by members of the staff, the proceeds being given to the Rawcester Benevolent Fund.

The fifth annual horticultural show and sports of the Bradford Corporation Tramway Employés' Social and Athletic Society were held on two days recently, and were quite successful, alike on the exhibiting, sporting, and attendance sides. The horticultural exhibits were rather fewer in number than last year, but the quality was distinctly good. The sports prizes were presented by the wife of Mr. R. W. Wilkinson, the general manager. The tramway band provided music.

On Saturday afternoon, the 27th inst., the staff, employés and friends of the County of London Electric Supply Co.'s Horticultural and Social Society held their fifth annual exhibition of vegetables, flowers, and fruit at "Oaklands," Cavendish Road, Clapham Park, S.W. Although exhibits were fewer in number, the quality was quite up to the usual standard. A magnificent exhibit of both fruit and vegetables was made by Sir Frederick Hall, M.P., D.S.O. Lady Hall kindly presented the prizes. Witty speeches were made by Sir Frederick Hall and by Sir Harry Renwick, K.B.E., and Mr. A. R. Bacon. Features of the afternoon were a wireless demonstration kindly arranged by Mr. T. D. Dallas, M.I.E.E., and sports arranged by a member of the Society. The proceedings were carried on until dusk, when dancing took place to the accompaniment of a band. All the exhibits were presented to local hospitals.

Lamp Taxation in Germany.—The German Government has introduced a Bill for increasing the tax on lamps. If passed, the new taxes, which are given below, will come into force on October 1st:—

	Carbon filament lamps. Tax per unit in marks.	Metal filament lamps, Nernst lamps and other types. Tax per unit in marks.
1. Up to 15 watts	0.20	0.40
2. Over 15 and up to 20 watts	0.40	0.80
3. Over 20 to 60 watts	0.80	1.60
4. Over 60 to 100 watts		
5. Over 100 to 200 watts	2.00	4.00

In the case of carbon filament lamps of a higher consumption than 200 watts, an additional tax of 1 mark is to be paid for each further 100 watts, or portion of 100 watts. Arc lamp carbons made of pure carbon, are to be taxed at 2.40 marks per kilogramme, and those formed of carbon and admixtures at 4 marks per kilogramme. The tax on burners for mercury vapour and similar lamps up to 100 watts is 4 marks each, and for those of further consumption, an addition of 4 marks is made for each further 100 watts or portion of 100 watts.

Incandescent gas mantles are to be subject to a tax of 0.40 mark each.

German-Italian Commercial Agreement.—The *Lokalanzeiger* states that the German-Italian Commercial Agreement was signed at Berlin on August 29th.—*Reuter's Trade Service* (Berlin).

Lead Market Report.—Messrs. J. Forster & Co. report that the closing prices on August 26th, were £23 7s. 6d. for August, and £22 15s. for November, against £23 7s. 6d. and £22 17s. 6d. respectively, at the end of last week.

The market has been 7s. 6d. lower than these figures, £23 being done for August on the 23rd and 24th, and 25th, and as low as £22 7s. 6d. for November on the 24th.

Business on the Metal Exchange has been on a somewhat larger scale, about 2,500 tons changing hands, but there is little speculative interest shown in lead, and what there is, is on the "bear" side. Delays in shipment of lead, against July contracts, both from Spain and America, obliged sellers to deliver wharf lead against July contracts, with a consequent large reduction in stocks here, and a corresponding increase of lead available for August contracts, which perhaps accounts for the easy conditions on the market last week. At the same time, there is no surplus foreign lead about, and the prospects for September arrivals are much on the short side.

Consumers have shown no disposition to buy beyond immediate requirements, and export business is very slack.

Encouraging Electric Foundries in Brazil.—A project is under the consideration of the Chamber to grant a subsidy of 200 contos of reis (nominally £10,000) to each of the first three electric foundries to be established in Brazil.—*Financial Times.*

Inquiry.—The present address of the firm trading under the name of O. G. & Co., Ltd., Birmingham and London, is required.

National Food Exhibition.—The above exhibition, which is to be held at Olympia in September, 1922, will present an opportunity to manufacturers of electrical cooking apparatus and utensils, dairy machinery, refrigerating plant, &c., to exhibit and extend the use of electricity in this most important direction.

Unemployment in South Africa.—Owing to the prevailing lack of employment even mechanics and better-class workers, including a number of skilled men, are accepting relief work. While this is to a certain extent due to the general depression, the position is largely caused by an influx of men from overseas, owing to the bad state of the engineering trade in Great Britain. A thousand unemployed have registered in the town. Unemployment is also rife in Cape Town and other large centres in the Cape Province.—*Reuter's Trade Service* (Johannesburg).

Canadian Preferential Tariff for West Indies.—The Canadian preferential tariff in favour of the West Indian Islands becomes effective on September 1st by proclamation.—*Reuter's Trade Service* (Ottawa).

New Spanish Companies.—The Hidroelectrica del Maestrazgo is the title of a Spanish company formed at Tortosa (Calle de Cervantes 14) for developing certain waterfalls for the generation of electric current to supply a number of towns in the provinces of Tarragona and Castellon. The capital of the company is 500,000 pesetas.

The Asociacion de Productores y Distribuidores de Electricidad has been formed in Spain to vindicate the rights of the producers and distributors of electrical energy against the arbitrary action of the Government and Government officials. Acts complained of are the imposition of heavy fines for slight faults of supply, exaction of the deposit of heavy guarantees for the discharge of fines, maintenance of the price of energy at pre-war rates, variation of terms of granted concessions, the incidence of the new customs duties, and penalties exacted for importing machinery not made in Spain, ignoring the national importance of the electrical industry, and other matters. Señor Urrantia is the spokesman in a vigorous campaign which has been begun.

New French Companies.—The Forges et Ateliers de Constructions Electriques de Jeumont is a company recently constituted at Paris (75, Boulevard Haussmann) with a capital of 80,000,000 fr., to take over certain assets of two other companies, namely the Société des Ateliers de Constructions Electriques du Nord et del'Est and the Société des Forces et Ateliers de la Longueville. Of the 320,000 250-fr. shares of the new company 160,000 are allotted to the former, and 150,000 to the latter, in consideration of their assets, the balance of 10,000 shares being subscribed in cash.

At Grenoble has been formed the Société d'Etudes des Chutes de la Moyenne-Isère, with a capital of 160,000 fr., with the object of acquiring existing rights for creating falls on the Middle Isère between the Saint Gervais bridge and the confluence of the Arly. Four hundred founders' shares and 400 250-fr. shares, fully paid, are allotted to the former owners of the rights, the remaining 240 shares being subscribed in cash.

The Société d'Electricité de Surgères, Agreferuille et Etensions has been formed at Surgères (Charente Inférieure) with a capital of 1,000,000 fr. (raisable to 3,000,000 fr. by simple decision of the Council), with the object of the generation, purchase, sale, transformation, and transport of energy in all its forms, and accessory applications.

With a capital of 500,000 fr., subscribed in cash, has been formed the Electricité Asea at Paris (114, Boulevard Haussman) for the manufacture, purchase, and sale of electric apparatus and material of all kinds.

Trieste Samples Fair.—The authorities of the annual Trieste Samples Fair, which was to open on September 11th, having invited H.M. Government to form a British propaganda and information bureau at the Fair, a stand was placed at the disposal of the British Consul-General free of charge, and the organisation of the bureau was commenced. Owing to the postponement of the Fair to May, 1922, the arrangements have been suspended for the present.

The Export Credits Scheme.—The Board of Trade has added Italy and Portugal (including Portuguese Colonies) to the list of countries included in the new export credits scheme. Inquiries in this connection should be addressed to the Director of the Export Credits Department, 73, Basinghall Street, London, E.C. 2, from whom forms of application can be obtained.

LIGHTING AND POWER NOTES.

Ashington (Northumberland).—Protest Against Lighting Agreement.—Ratepayers of the district are petitioning the Ministry of Health to investigate a proposal of the local council to enter into a 10-years' agreement for public lighting by electricity on the ground that it is creating an unnecessary monopoly.—*The Times.*

Belfast.—Consultants' Report.—At the monthly meeting of the Corporation on August 2nd, it was stated that the consulting engineers, Messrs. Preece, Cardew & Rider, desired to withdraw for the present their report dated June 7th on the financial position of the electricity undertaking as it is likely to be when the first section of the Harbour Power Station is completed. A resolution was, however, adopted to the effect that each member of the Council be furnished with a copy of the report. These copies were received by the members, together with the agenda for the meeting on September 1st. Councillor Alexander gave notice that he intended to move:—"That in view of the very grave state of the city's electricity undertaking, the Corporation forthwith dispenses with the services of their consultants, and that the opinion of senior counsel be taken as to their responsibility and the responsibility of Sir John Snell in the matter."

Bradford.—Motors and Rates.—Despite the understood rule that tenants' fixtures are not included in the valuation of premises for rating, it appears that electric motors in Bradford industrial establishments are liable to assessment, even though most of them are tenants' fixtures, as distinct from big permanent plant like steam power machinery. The local custom in valuation of business premises has been to include only such machinery as would pass with the freehold.

One firm has been advised to give the Corporation notice to remove a 15-h.p. motor. Therefore, the immediate result of insistence on the small amount to be yielded by this rating, is that the city loses £7 10s. per annum for hire of the motor and the revenue from the electricity which would have been consumed.

Canada.—Hamilton (Ont.).—Every house in the city of Hamilton, Ontario, is to be equipped with electricity for heating and cooking. This decision has been reached by a commission which has been studying the scheme for some time. Electricity sufficient for cooking, and for heating and lighting a six-roomed house will cost about 14s. a month, the commission estimates, apart from the initial wiring expense of about £50.—*Daily Express.*

Chester.—Joint Distributing Authority.—The Chester Rural District Council has authorised its Electricity Committee to confer with the Chester Corporation electrical engineer, on the question of the formation of a joint distributing authority. It was explained that the Chester Corporation hoped to obtain electricity supplies from H.M. Factory at Queensferry in November, when it would be in a position to supply all the requirements of the city and the district. It was stated that the cost of cables, &c., where laid in the Rural Council's area, would fall on that Council whose idea was that the scheme should be self-supporting.

Continental.—France.—The strikes at Strasburg, affecting mainly metallurgists and electricians, are having far-reaching results. The town is entirely deprived of ordinary lighting, only the central streets being lit up by searchlights and a few powerful acetylene lamps. The inhabitants were considerably astonished to see the first tramcar which was run after the electrician's strike began; it was drawn by a railway engine of a type used on light railways. A skeleton tramway service is now being run in this manner.

Although the workers in the gas and electricity works at Strasburg and also in ten factories have come out, the metallurgists' strike in the Lower Rhine area is not complete. Of 46 works, 22 are now working, the reduced wages having been accepted. In two of the most important metallurgical works in Strasburg, work has been partially resumed.—*Reuter's Trade Service* (Paris).

Austria.—The City of Vienna, in conjunction with a banking syndicate, is forming a company with a capital of half-a-million crowns to develop water power near Vienna sufficient to supply the city with electricity. The cost of construction will be covered by an issue of bonds aggregating 10 milliards of crowns, about one-third of which will be issued in the first five years.—*Reuter's Trade Service* (Vienna).

Poland.—On August 24th the employés of the Warsaw municipal electricity works, came out on strike, depriving the city of light and power. The tramway employés had already been on strike two days causing a breakdown of transport. It was reported that the gasworkers had also ceased work.

Exeter.—Fire at Power Station.—An outbreak of fire, believed to have been caused by a spark, occurred at the Corporation power station early on August 24th.

Flames were noticed on the wooden roof of the boiler house at the rear of the station. There was for a time danger to the generating plant, but the fire brigade, which promptly arrived, got the outbreak under control, and there was no stoppage of the electricity supply. A first estimate puts the damage at several hundred pounds.

Crieff.—Electricity Scheme.—Mr. J. E. Macewan, consulting engineer, Glasgow, recommends the Town Council to institute an electricity supply, and to install Diesel oil engines. The estimated expenditure, including expenses in connection with the obtaining of an order and installation of plant is £15,650. The yearly outlays are estimated as follows: Standing charges, £2,223, and running expenses £1,656, a total of £3,879. The estimated revenue is £4,275.

Haslingden.—Loan Sanctioned.—The Corporation has received the sanction of the Electricity Commissioners, to the borrowing of £10,000 for electricity purposes, made up as follows: Mains and services, £7,000; sub-stations, £3,000.

Haworth (Yorks.).—Supply Problem.—At an inquiry in 1915, the Council objected to inclusion in the Keighley supply scheme, preferring to promote an order separately for its own area. Nothing has yet been heard of this order, and the district is not included amongst the other urban districts in which Keighley has obtained power to supply.

Leek (Staffs.).—Loan.—The Urban Council is seeking sanction to borrow £18,500 for the provision of additional plant at the electricity works.

Matlock.—Water Power.—Some time ago a letter was read at a Council meeting from Mr. D. Palmer Pearson suggesting that electricity for the district could be secured from turbines placed in the Derwent, and he gave the locality as the Collingwood stream, at the northern end of Matlock Dale.

On August 23rd, the Council considered the report of the engineers, Messrs, Grime & Frith, of Manchester, and it was explained that the engineers, on their inspection of the district, visited the High Tor Works, and it was there shown that the works could take the whole flow of the Derwent at its present level.—*Sheffield Daily Telegraph.*

Morecambe.—Loan Sanctioned.—Sanction has been received from the Electricity Commissioners to borrow £6,000 for the purchase of mains and meters for the electric light undertaking.

Oldham.—Year's Working.—The report of the borough electrical engineer (Mr. F. L. Ogden), for the year ended March 25th last, shows that the total revenue of the electricity undertaking was £146,846, as compared with £119,865 in the preceding year. Working expenses amounted to £117,326, as against £79,139, leaving a gross balance of £29,520 (£40,426). After adding a balance of £10,774 from the previous year's accounts and paying capital charges, &c., a credit balance of £3,836 remained. The large increase in working expenses is due to the increased cost of fuel and labour, and to a larger expenditure upon repairs, maintenance and renewals. The total number of units sold was 18,340,242 as against 16,693,515 in 1919-20. The maximum load rose from 9,292 kW to 10,996 kW.

South Africa.—Johannesburg.—The municipality proposes to call for tenders for two new boilers costing £20,000; a converting plant to cost £12,000; and other plant. There is also a proposal to construct a large new generating station making provision for future extensions, as the town grows, up to an approximate total of 54,000 kW. Machinery and plant estimated to cost £119,551 is urgently needed to equip the power station for the next two years. The Tramway and Lighting Committee recommends the Council to apply to the Administration for authority to borrow £119,551.

Grahamstown.—The City Council has adopted a scheme for the electric lighting of the district, involving an expenditure of £65,000.

Southport.—Extension of Supply.—The Corporation is applying to the Electricity Commissioners for an order to supply electricity to that part of the Kew district within the jurisdiction of the West Lancashire Rural District Council.

South Shields.—Year's Working.—The report upon the Corporation electricity supply department (engineer, Mr. E. Moxon) for the year ended March 31st last records a total revenue of £93,066, as compared with £66,377 in the preceding year. Working expenses amounted to £57,655, as against £43,138, leaving a gross profit of £35,411 (£23,239). The net result, after payment of all capital charges, &c., was a profit of £10,218, comparing very favourably with a profit of £3,514 in 1919-20. The number of units sold rose from 6,962,929 to 7,955,693, and the average price obtained per unit from 2.19d. to 2.69d.

Proposed Price Reduction.—Owing to the satisfactory surplus obtained during the past year, and also to the fact that the engineer considers that the highest level of working costs has been reached, the Electricity Committee recommends a substantial reduction in charges, to take effect at once.

Teignmouth.—Electric Lighting.—At a meeting of the Chamber of Commerce reference was made to the question of electric lighting for the town, and opinions were expressed that Dr. Purves's proposal to erect three miles of overhead cable in two years was insufficient.

Wakefield.—Extension of Supply.—The City Council has decided to make application to the Electricity Commissioners for power to supply electricity to the parish of Lupset.

TRAMWAY AND RAILWAY NOTES.

Bolton.—Market Siding.—Negotiations have been completed for the construction of a tramway siding at the south end of the wholesale market, to serve as a terminus for the Daubhill and Deane route, so as to relieve the congestion of traffic in Great Moor Street.

Birkenhead.—Year's Working.—The annual report of the manager of the borough tramways and motors department (Mr. Cyril Clarke), for the year ended March 31st, 1921, records that the revenue of the tramways amounted to £152,304, as compared with £148,179 in 1919-20. Working expenses absorbed £116,060, as against £100,476, leaving a gross surplus of £36,244 (£47,703). The net result, after payment of interest, sinking fund contribution, and income tax, was a profit of £4,033, a considerable decline from last year's balance of £16,104. The number of passengers carried and car-miles run were almost the same as in the previous year, but there was a slight decline in the number of passengers and a small increase in the number of car miles.

Result of Fare Increase.—The Tramway Committee's report upon the result of the increased fares during the first week of their operation shows that compared with the corresponding week last year there was a decline of over 88,000 in the number of passengers and a reduction of £142 in the receipts. Compared with the previous week, the falling-off in the number of passengers was 22,500.

Canada.—Toronto.—*The Times* Toronto correspondent states that the tramways were to pass into the possession of the municipality on September 1st. It was announced that the fares would be increased.

Chile.—Railway Electrification.—The Government has decided to take up a loan of £2,700,000 for the purpose of electrifying 200 kilometres of railway between Santiago and Valparaso.—*Reuter's Trade Service* (Santiago de Chile).

Gateshead.—Collision.—On August 24th a tramcar was proceeding up West Street, which is a steep gradient, when it was run into by a motor coach which was proceeding in the same direction. The two vehicles came into contact with considerable force, and as a result the motorman's platform and controlling mechanism of the tramcar were torn away. With nothing to check it, the car at once began to fall backward down the hill. Upon the same track another car was travelling in the same direction. The motorman of this car saw the collision, and at once realised that his car was in peril as the first tramcar backed down the hill. He at once applied his brakes to their full power, and held on to them until the first car dashed into his car and was brought to a standstill. None of the passengers were seriously injured.

Glasgow.—Enlarged Borrowing Powers Required.—With a view to meeting expenditure on tramway extensions, motor omnibuses, &c., the Tramway Committee has recommended the Town Council to increase the borrowing powers of the department to the extent of £600,000.

London.—Fire.—On August 24th an L.C.C. tramcar, which was standing in the Brixton Road, suddenly burst into flames. It is reported that this happened immediately after the fixing of a collector shoe in changing from overhead to conduit working. The few occupants of the car escaped without injury.

Derailment.—On August 28th, a London United Tramways car jumped the track at Shepherd's Bush. It crossed the road and mounted the pavement, being brought to a stop by some railings. Several passengers sustained shock and slight injuries.

Collision.—Another accidend occurred at Greenwich on August 25th. A motor coach collided with an L.C.C. tramcar, and six persons, including the two drivers, were injured.

Manchester.—Threatened Strike.—A serious position has arisen at Manchester on account of the employment of non-union labour—five men—in the tramway department. The trade union employés have balloted in favour of a stoppage during the next week-end if the men in question refuse to join the union or are not discharged.

Northampton.—Extension of Time.—The Minister of Transport has further extended the time of the Northampton Corporation Act, 1911, for the construction of tramways until August, 1922.

Portrush.—Giant's Causeway Line.—It is reported that the Portrush and Giant's Causeway Electric Tramway, a very early electric line, may be forced to close down owing to a combination of adverse circumstances.

Southport.—Power for Tramways.—The alterations which have recently taken place at the Crowlands power station will consumers, the Tramway Committee will be charged at the to work the whole of the Corporation tramways. Subject to any future revision of charges by the Corporation to private consumers, the Tramway Committee will be charged at the rate of 2d. per unit up to 100,000 units a year; 1½d. per unit for additional power up to 300,000 units a year; 1¼d. for further supplies up to 500,000 units a year; and 1¼d. for supplies above 500,000 units a year.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—Proposed New Wireless Station.—It is stated that the Department of Naval Affairs has in view the installation of a very powerful continuous-wave wireless station near Vancouver to undertake land work and to communicate with distant points up the coast, leaving the present station at Point Grey to handle shipping business only.—*Reuter's Trade Service* (Vancouver).

Electrical Storm.—The Cardiff telephone system was dislocated by an electrical storm early in the morning on August 29th. No calls to area subscribers could be put through. Trunk calls were received at the exchange, but could not be connected locally. After thirty minutes the service became normal again, says the *Daily Express*.

Russia.—Telephone and Telegram Fees.—As from August 1st the following charges were to be made for telephones and telegrams: A single subscriber has to pay 350,000 roubles a year, while a "collective" telephone—that is, one installed in a large house and used by a number of persons—costs 500,000 roubles a year. The fee for three minutes' conversation on a long-distance or suburban telephone has been raised from 1,800 to 7,200 roubles. The installation of a new apparatus costs 500,000 roubles. The persons or organisations who have the right to possess and use telephones on these conditions are those who previously were allowed to have the telephone free of charge. The charges for telegrams are as follows: Local telegrams, 100 roubles a word; inter-urban telegrams, 500 roubles; and urgent telegrams, 3,000 roubles.—*Morning Post*.

Sweden.—Ships' Wireless Installations.—As a result of the British regulation which came in force last December requiring vessels of 1,600 tons or more plying to British ports to carry wireless installations, the wireless section of the Swedish Telegraphic Administration has been overwhelmed with orders for new wireless apparatus. About 200 ships are required as a result of this regulation to be fitted with wireless, and the installations are not yet entirely finished. Some of these would have been fitted without the special incentive of the British regulation. When Swedish shipping recovers from its present depression a further thirty will have to be fitted. In Göteborg harbour there are already two salvage vessels fitted with wireless apparatus; in Stockholm harbour there are three, and will shortly be four.—*Economic Review*.

Switzerland.—Temporary Wireless Station.—In order to facilitate the transmission of Press dispatches from Geneva during the discussion of the Silesian problem by the Council of the League of Nations and during the second assembly of the League, the Marconi Co. again erected in Switzerland, at the request of the Swiss Government, a temporary wireless station giving precedence to news messages. The transmitting station, which is at Borno, will be operated automatically at high speed and by distant control from a room adjacent to the Assembly Hall of the League in Geneva. Communication will be established with England and several other European countries. A staff of experts has been sent from London to conduct the service which opened on August 30th.

The Telegraph Service.—Telegraphists' Bonus.—The daily Press announces that the Government has decided to appeal against Mr. Justice Darling's decision on the question of the payment of a bonus to General Post Office telegraphists who enlisted in the Royal Engineers. Mr. R. T. Sutton, along with many others, joined the signal section of the R.E. under contract with the Government that he should receive on return from the war full civil pay. He did not, however, receive the amount by which the civil pay was increased by awards (bonuses) during his military service, says the *Evening News*.

The Telephone Service.—Scarborough.—On Saturday afternoon the telephone exchange service was transferred from the old premises at Vernon Place corner to the General Post Office in Aberdeen Walk. The new switchboard is a common battery manual No. 10 of 2,000 subscribers capacity, although at present Scarborough has only 900 subscribers. Trunk calls will be dealt with direct by the exchange operators, and it is expected that before very long lines to Malton, Bridlington, Whitby, York, Middlesbrough, &c., which are at present trunk calls, will be worked merely as junction services.

Hull.—The Corporation telephone department experienced a loss of £13,279 on the year's operations.—*The Times*.

U.S.A.—New Long Island Wireless Station.—What is claimed to be the largest and most powerful radio plant in the world, the new central station of the Radio Corporation of America on Long Island, N.Y., will be formally opened for service in the latter part of August or early in September. Two of the wings or spokes of the wheel-like arrangement of the antenna towers, that has been described in our pages, are complete. Twelve steel towers, each 400 ft. high, compose the two wings or one operating unit. When the entire station is complete there will be twelve of these. The total distance between the first and twelfth towers of the complete unit is

approximately three miles. In the centre of these twelve towers is the central power house, which is now completed, and two of the 200-kW Alexanderson high-frequency alternators have been installed and are ready for operation.

The receiving station designed to operate in connection with "Radio Central" is at Riverhead, L.I., about 17 miles away. This receiving centre is capable of intercepting six different messages simultaneously. The control system is so arranged that there are no actual receiving operators present. The aerials pick up the signals, special apparatus in turn directs these to a regular land wire, and finally the messages are received in New York City.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—MELBOURNE.—October 19th. Victorian Government Railways. Three-phase motors, starters, circuit breakers, and switches. Contract No. 34,181.*

Bristol.—September 16th. Electricity Department. One 500-kW rotary converter. (August 26th.)

Bulgaria.—September 19th. Supply of 2,000 telephones. Direction des Postes, Telegraphes et des Transports bulgares, Sofia.

Dorchester.—September 10th. Electricity Committee. Replating battery, &c. (August 26th.)

Eastbourne.—September 26th. Electricity Department. One water-tube boiler, fan and chimney, boiler-feed pump and piping; one 2,500-kW turbo-alternator with condensing plant and pipework. (See this issue.)

Halifax.—September 10th. Electricity Committee. Steelwork in connection with foundations for new turbine set at the electricity generating station.—Mr. A. C. Tipple, acting borough engineer, Crossley Street.

Horsham.—September 3rd. Electricity Department. One 3-crank, triple-expansion engine, coupled to a 300-kW d.c., 460/500-V generator, or alternatively, one 2-crank compound engine, coupled to generator as above. (August 19th.)

Ilford.—September 9th. Electricity Department. Air compressor, motor and starter. (August 19th.)

London.—FULHAM.—September 10th. Electricity Department. A.c. motor-driven centrifugal circulating pump with pipework and valves. (August 19th.)

H.M. Office of Works. September 16th. Supply of electrical and mechanical labour-in-daywork in the Cardiff district. (August 26th.)

BERMONDSEY.—September 23rd. Board of Guardians. Six months' supply of electric lamps. Mr. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

Malta.—September 15th. Government of Malta. Single-phase a.c. meters. (August 19th.)

Manchester.—September 13th. Tramways Committee. Motors, controllers and trucks, &c. Mr. J. M. M'Elroy, general manager Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.*

November 29th. Public Works Department, Mangahao electric power scheme: 3 water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA single-phase transformers, insulators, lightning arresters, switchboard, &c.*

October 15th. Corporation. Two water-tube boilers with feed-water heaters, superheaters, stokers, &c.; one 5,000-kW turbo-alternator with condensing plant. (See this issue.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

South Africa.—JOHANNESBURG. November 7th. Rand Water Board. Two 350-kW steam-driven electrical generating sets, complete with switchboards and all accessories.*

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

FORTHCOMING EVENTS.

Institute of Marine Engineers.—Tuesday, September 6th. At the Institute, The Minories, Tower Hill, E.C. At 6.30 p.m. Paper on "The Burning of Oil Fuel, and the arrangement of machinery necessary, together with observations and comments drawn from actual conditions," by Mr. A. Keens.

British Association for the Advancement of Science.—September 7th-14th. At Edinburgh. Eighty-ninth annual meeting.

Shipping, Engineering and Machinery Exhibition.—September 7th to 28th. At Olympia, W.

NOTES.

Appointments Vacant.—Associate Professor of Electrical Engineering ($3,800 per annum), for the New Provincial University of British Columbia; electrical engineer and manager (£800), for the Corporation of Southport Electricity Department.

Fatality.—Edward Braithwaite, electrician at the works of the Yorkshire Electric Power Co., was killed in the course of his work on August 28th. He was examining a defective lamp fitting on the top of the ash tip at the Thornhill works, when the tip man heard him call out and saw him clinging to the electric wires. When he succeeded in pulling him off the wires to the ground, Braithwaite was unconscious, and artificial respiration methods failed to have effect.

Educational.—Advanced evening technological courses have been arranged in electrical, civil and mechanical engineering at Leeds University, commencing on September 12th. Certificates of attendance for four sessions at courses in mathematics, mechanics and machine drawing, or evidence of similar work elsewhere, are required. In the absence of such evidence there is an entrance examination, but students of 22 years of age and over may be admitted without examination at the discretion of the head of the department.

Heat-resisting Glass.—The Montreal convention of the Society for Chemical Research, which was opened on August 29th by Sir William Pope, is being attended by noted chemists of Great Britain, Canada, and the United States. Among the scientific papers to be presented is one dealing with a new glass, which, the inventor claims, admits unlimited light while eliminating all heat rays.—*Daily Express.*

Seeing Through Criminals.—The *Daily Mail* recently recorded the strange case of a woman who, by means of X-rays, was discovered to have swallowed two stolen rings. This journal also recalls another instance in which the interior of a criminal was examined by the agency of the rays; in this case it was a Berlin burglar who had swallowed a *bunch of skeleton keys*. Radiology is likely to become an unpopular science to members of this industry.

Turbine Locomotives.—The *Dagens Nyheter* learns that the Ljungstrom Steam Turbine Co. has built a new type of locomotive from a Swedish invention which is now being tested by the State Railways. The chief innovation in the new locomotive is that reciprocating machinery has been replaced by a steam turbine. The locomotive is also equipped with a condenser and other appliances for economising fuel. Another turbine locomotive is being tested in Switzerland.—*Reuter's Trade Service* (Stockholm). It will be remembered that rumour has it that a similar type of locomotive has also been built in this country.

Institution Notes.—ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—On August 24th the members of the Midland Branch of the Association paid a visit to the works of the General Electric Co., Ltd., at Witton. After inspecting the various departments, where the manufacture of motors and generators was in progress, the visitors were entertained to luncheon at the Imperial Hotel, Birmingham, by Mr. T. Evan Davies, general manager of the works.

INSTITUTION OF MINING ENGINEERS.—The offices of the Institution have been removed from 39, Victoria Street, Westminster, to Cleveland House, 225, City Road, London, E.C.1. Tel. No.: Clerkenwell 3670; tel. add.: Instimini, London.

Use of Electricity in Scottish Coking Seams.—The referee appointed to arbitrate in the case mentioned in our issue of July 22nd last, p. 123 (Mr. John Gemmell), states with regard to the use of electrical plant at Auchengeich Colliery, Arthurlie, that if used in the coking coal seam at or within 50 yards of the face for any purpose (other than that of shot-firing or of obtaining light by means of electric safety lamps) it would on account of the risk of explosion of gas be dangerous to life.

Bolshevist Dreams.—"Our dreams are of establishing the most modern system of electrification for our entire industry and agriculture; if possible with the United States' assistance," M. Chicherin, Soviet Russia's Foreign Minister, is reported to have remarked recently in an interview with a United Press of America reporter.

"We intend to establish powerful electrical centres all over Russia, utilising the natural power available locally—coal in the Don region and certain parts of Siberia, naphtha in the southern districts, and water power wherever possible. We are prepared to give concessionaires every possible guarantee of protection."

Electric Wiring at the Royal Albert Docks.—Another example of the increasing use of c.t.s. cables is provided by the new Royal Albert Dock, which was recently opened by H.M. the King. This magnificent dock, constructed by the Port of London Authority, is equipped with the most up-to-date travelling electrical cranes, and for the trailing cables c.t.s. is used exclusively. The same type of cable is also used wherever cables have to cross the water, as in feeding island jetties. The latter each carry four 3-ton travelling cranes. Each crane has a range of travel of 150 ft., and the cable is led over a series of pulleys, as shown in the accompanying illustration. C.t.s. cable is, of course, a type which lends itself, particularly to such conditions as these. On the dock side there are a number of 25-ton cranes which are similarly fed by c.t.s. cables. The examples of wiring at these new docks demonstrate the manner in which the c.t.s. cables are run,

C.T.S. Crane Cable.

in striking contrast to the extremely careful and elaborate manner in which it was found necessary to install the type of cable previously used. It should be mentioned that c.t.s. wire is run through the water without any external protection, and also underneath the floor of the jetty, feeding the various plug-connection boxes to which the c.t.s. trailing cables are attached.

Electric Ploughs in Russia.—At the Briansk works a new electrical plough has been prepared which on trial has yielded very satisfactory results. The plough has 16 shares—eight on each side. It will do a lot of work and will plough as deep as 14 in. The capacity of the implement is considerable, and it does not refuse virgin land or land that has not been ploughed for a long time. Twenty are being made at the Briansk works. It is the first such plough made in Russia, and it is hoped that it will be one of the chief features in the electrification of the country's agriculture.

Labour Control of Italian Industries.—The text of the much-talked-of Bill for the labour control of factories that was introduced in the Italian Chamber by Sr. Giolitti last month is now available, but in view of the resignation of his Cabinet, it remains to be seen what the fate of the Bill will be. The lengthy preamble explains the reasons for the introduction of the Bill, and states that the divergencies of the opinions of the General Confederations of Industry and Labour were too great to admit of agreement; therefore, each submitted a scheme to the Government which was thereby guided in drafting the Bill.

Concerning the substance of the Bill, provision is made for the control of ten industries, including the electrical, engineering, iron, steel, and chemical industries, by the workmen and the reasons for so doing are set out. State and municipal industries, those established for a period of less than four years, and factories employing less than 60 hands, are to be exempt from control. A Committee of Control will be elected every three years by the workers in each industry, and of its nine members six will be chosen by the workmen, and three by the technical, clerical, and managerial staffs. Two or more workmen, who will also be elected every three years, will be appointed by the Committee as stewards to each factory to exercise control, but their functions will be determined by regulations which are to be issued. They will be empowered to furnish the Committee with information relating to the costs of raw materials and production, administrative and production methods—but not trade secrets—wages, profits, and the constitution of capital. Two employers' representatives and one of the Supreme Labour Council will have the right to attend and speak at the meetings of the Control Committee, they will have no vote, but will have power to demand entry of their remarks in the minutes, and to prohibit the publication in the reports, or even entries in the minutes, of information calculated to prejudice the interests of the industries.

A Board of nine employers' representatives is to be elected every three years under special regulations to negotiate with the Control Committee for the purpose of compelling individual manufacturers to carry out the provisions of the Act. The Control Committee will be entitled to attend and speak—but not vote—at the meetings of the Board, and at least once a year the employés' representatives and the Control Committees are to meet to consider improved methods of working the industry, means of increasing production, and to settle any disputes.

Special regulations to govern the hire and dismissal of workmen are to be framed, and employment bureaux, composed of repesentatives of the Control Committee and the employers, are to be established to register and engage persons seeking work. The dismissal of employés is to be governed by rules, and in the event of staff reduction, before any hands are dismissed, the hours of work are to be reduced to a minimum of 36 per week, with a proportionate reduction of wages, after which preference in the retention of hands is to be given to the oldest workmen, and those having large families.

If circumstances so require, more than one Control Committee can be appointed for one industry; the expenses of such committees are to be borne in equal shares by the men and employers; all disputes must be settled by arbitration; and, finally, penalties may be imposed for breaches of the Act, and of the regulations relating thereto.

New Bearing Material.—A new bearing material called Genelite, recently developed in the research laboratory of the General Electric Co. (U.S.A.), has given remarkable results in a series of tests made to determine its performance, both when lubricated and self-lubricating.

It consists of a mechanical mixture of a high-grade "synthetic" bronze, and graphite, the latter amounting to about 40 per cent. by volume of the whole mass. Since the material cannot be melted and poured into moulds like ordinary metals, its formation into bearings is accomplished by a special process. It is made from the oxides of tin, lead, and copper (mixed in the proportions to form a high-grade bronze) plus graphite, all the ingredients being in a finely divided state. Graphite is added in sufficient excess quantity to reduce the oxides to the metals and still leave the required content in the finished material. The oxides are partly reduced by heating the mixture, after which it is still in powdered form, but is then pressed as nearly as possible to the required shape in massive metal moulds.

In the pressed form it is still too brittle to stand handling, so it is given a final heat-treatment which reduces and sinters the metals together into a homogeneous bronze, holding the graphite uniformly distributed throughout the mass. The baking fixes the graphite so securely within the mass that it cannot be separated or washed out, even if the metal is lubricated. The material has the general appearance and body of bronze, but the characteristics are different. It does not machine readily by ordinary methods, but can easily be ground, which has been found to be the best method of handling it in production. Neither has it the physical characteristics of bronze, having very low tensile strength, but being able to withstand high compressive strains.

Another marked difference is its porosity, it being able to absorb as much as 2½ per cent. by weight of oil. This feature is made use of in some of the high-speed applications where oil is applied to the outside of the bushing and carried to the bearing surface by capillary attraction.

A bearing made from this material never seizes or "freezes" as these expressions are commonly understood. The metal of the shaft and bearing never flow and weld together as a result of bearing friction. If the Genelite bearing sticks, owing to having been fitted too close, examination will show that no damage has been done, either to the bearing or the shaft, and they can be reassembled after the bearing has been ground down to proper size.

Genelite is useful where lubrication is either poor or neglected altogether owing to the inaccessibility of the bearing.—*Chem. and Met. Engineering.*

Church Telephones.—The deaf of the province having formed themselves into a mutual aid association, which has submitted a request to the ecclesiastical authorities for more religious facilities, special churches for the deaf are to be built in the Province of Hanover. They will be provided with a telephone transmitter, into which the preacher directs his voice, together with from 50 to 100 receivers to be worn on the worshippers' heads.

Service v. Trouble.—Following a prize-winning suggestion in an employés' suggestion contest, the Oklahoma Gas & Electric Co., Oklahoma City, has issued orders that the former "trouble department" shall henceforth be known as the "service department." The line of reasoning followed by the company is that this department is the one charged with the duty of seeing that customers receive service at all times, and that in a great majority of cases the interruption is not due to trouble on the lines of the company. It is believed that the change of name will materially assist the company in its attempt to convince customers that the commodity furnished is primarily service and secondarily electricity. The policy of the company has been that the degree of satisfaction derived by individual customers is influenced by continuity and quality of service rather than by the mere use of the commercial product supplied. In selecting an employé to take charge of this work consideration was given to the personal qualities of diplomacy and energy, while thorough information concerning the functions of the various departments of the company was another decisive factor.—*Electrical World.*

Electric Vehicles in the U.S.A.—Notwithstanding the tremendous output of cheap petrol-driven passenger cars and trucks, which are sold at prices much below those charged for electrically-driven vehicles, the advantages for certain purposes of the electric car and the electric lorry are gradually being realised by an increasing number of firms and individuals. Electric passenger cars are slowly making headway in the larger American cities among doctors, travellers, and others who are largely occupied in making frequent calls within a restricted area; they are also used as auxiliary cars by wealthy people who find them easy to drive and, therefore, very convenient in emergencies. Many manufacturers and department stores are using small electric trucks in increasing numbers; most of these firms formerly used gasolene-propelled vehicles exclusively, and it was only after proving the superiority of electrically-driven trucks for short hauls that the change was made.

No official figures are published showing the number of electric vehicles in use in the United States, but there were 3,142 in operation in New York City in March, 1921, as compared with 2,495 in 1913. The increase may not appear to be large, but allowance should be made for the extremely keen competition provided by the innumerable types of cheap petrol-driven vehicles now on the American market. A wholesale baker, who has several branches in New York, Buffalo, and other Eastern cities, owns more than a thousand small electric trucks, while several department stores in New York City each have 100 or more in operation. The New York Post Office recently authorised the expenditure of 50,000 dollars for the purpose of testing electric trucks in the transportation of mail matter. Comparisons will then be made with the records of petrol trucks used on the same routes and carrying similar loads.

Detroit is said to possess the best electric taxi-cab service in the United States, and quite a number of these public vehicles are in operation in other western cities, but they have not yet appeared on the streets of New York. An exhibit of electrically-operated trucks will be a feature of the New York Electrical Show, which is to be held in the Grand Central Palace from September 28th to October 7th.—*Reuter's Trade Service* (New York).

Rearing Chickens Electrically.—Labour-saving devices on the farm are among the most important contributions which electricity has made towards rural progress. At least 10,000 farms, says the New York *Sun*, will be supplied with electric light and power when the plant now being constructed by the Ontario Government is completed, and in this connection the following account which the *Journal of Electricity* gives of the practical elimination of all human labour, and the efficient accomplishment of a task that formerly could only be undertaken on a much smaller scale, and with infinite trouble, is therefore of interest. The chicken-brooding plant owned by Mr. J. W. Dobbins of Sebastopol, California, is said to be one of the largest and most modern in the world, and is so conveniently arranged that the services of only one man are required to raise and handle thousands of chickens. The electrical features of these modern chicken brooders have contributed so much to their success that a new field has been opened up for further practical application of electrical appliances. The large number of Mazda lamps together with the heaters and motors make up a combined load which is well worth while, and extends over a period of approximately nine months, beginning in the latter part of September and extending into June.

At the present time Mr. Dobbins has four brooder houses. One takes care of 4,000 chickens. The other three houses are each capable of handling 1,500 chickens.

The usual principle of brooders is to set the heater at a central point and place the chickens about it, or to set it in a long line brooder and have the chickens run in or out on one side. These methods, according to Mr. Dobbins, are unscientific in that they do not radiate the heat so as to cover all the chickens at one time with an even and uniform temperature. The new principle which he has worked out reverses this old method, and it completely surrounds the chickens with the heat.

All the brooders are constructed in a rectangular form, with a well hole in the centre, which is surrounded with a double coil of hot water circulating pipes placed under a board covering all around it. Around the outside of the brooder is a fringed billiard cloth. The well has a cover which can be raised or lowered, and a ventilator in the apex controlled by a thermostat. When the chicks are put in at the start they are kept in the well space during the entire first day. The next day they are allowed a three-foot space all round the brooder, which is enlarged day by day as they grow older. The feeding during the first two days is done in the well. Each brooder has an independent hot water circulating system, heated by the latest 2-kW electrical heaters which have been developed by the Edison Electric Appliance Co. They are all equipped with thermostats which maintain a remarkable evenness of temperature in the brooders.

Putting the chicks to bed at night has always been a problem, but this difficulty has been overcome in a very novel and simple manner. Lights have been placed around the inside of each brooder well. When the time comes to put the chicks to bed, the attendant simply turns off all the lights except those in the brooder. Since chicks do not like to be running around in the dark they immediately flock into the brooder where the light is, and in a few minutes the lights can be turned out and all the chickens will be in the brooder. Each of the buildings is thoroughly lighted so that the houses can be brilliantly illuminated in the morning and late afternoon in order that the chicks can be kept busy 15 hours a day. There are 115 40-watt lights in the four buildings.

The drinking water is supplied by new principle fountains. They are designed to furnish fresh running water constantly, and at the same time are automatically self-cleaning. Each fountain is equipped with electric lights for night use. The lights illuminate the rippling surface of the water and the chicks will drink where otherwise they would not. Other conveniences, such as blinds for the windows, automatic feeders, and so forth, are all worked out so that the routine involves a minimum amount of time and labour.

The water supply is taken care of by a 5-h.p. motor controlled by a float switch. This automatically furnishes an abundance of water at all times. Another motor is used for the feed cutter. Vacuum cleaners are used to pick up all straw, dust and dry droppings. Each house is supplied with a stationary motor-driven spraying pump and whitewashing apparatus equipped with a sufficient length of hose to reach every crevice both inside and outside the building.

The electric control of the whole plant is most thorough and complete. All human agencies are eliminated wherever possible. An electric bell system is so arranged that an alarm is sounded if the heat or lighting fails at any time.

Offhand, one might think that this would be a very expensive system to operate, but such is not the case. Any other system would require more help in addition to the maintenance of some other class of heating and lighting. The plant has shown a remarkable record for percentage of chickens raised. It has been so satisfactory that the owner is planning another larger and more elaborate building. The electrical equipment and the circulating water system were furnished and installed by the J. L. Bone Co.

Carbon Monoxide in Gas.—The Departmental Committee appointed by the Board of Trade in January "to inquire into the question whether it is necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes" has issued its report, which states that on the balance of advantage to the public, it is not necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes. The Committee suggests that it should be made an offence to supply any gas for domestic purposes which does not possess the distinctive pungent smell of coal gas.—*The Times.*

Super-power Survey in the U.S.A.—The committee which has been organised to study the need or desirability of working toward a super-power transmission system in the north-west States has commenced operations, and data are to be compiled. It is not expected that steps towards actual construction will be taken for several years as the immediate needs of the territory are being satisfactorily taken care of by the existing organisations and transmission systems. Until the industrial expansion exceeds the capacities of the present systems and the available minor power sites are all developed there appears unlikely to be any economic pressure which will force the development of the major power sites at which energy can feasibly be developed only in large blocks. In this territory the primary basis for the development of a super-power transmission system is not the saving of fuel, but the expansion of industry and agriculture through the use of the large hydro-electric resources as yet virtually untouched.—*Electrical World.*

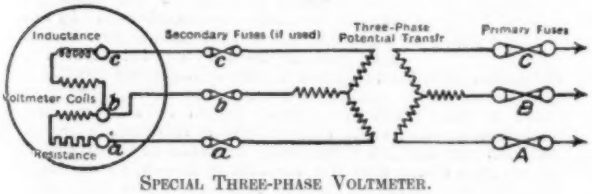
Colonial Research.—The Committee on Research in the Colonies, which was appointed by Lord Milner in November, 1920, reports that for the recruiting of scientific departments in the Colonies the Universities and allied institutions in this country can most usefully assist by encouraging post-graduate study and by providing facilities in their laboratories for the training of students in the principles and methods of independent research. For the adequate development of this post-graduate study all witnesses were of the opinion that the increase of research fellowships or studentships would be of prime importance.

Dransfield's Special Voltmeter.—With reference to the note in our August 19th issue on the subject of "Testing for Phase Sequence," the following brief description of a device (Patent No. 5,676/15), which was patented by Mr. H. S. Dransfield some years ago, might be of interest.

This instrument is designed for use on three-phase circuits, more particularly where potential transformers are used for the purpose of energising meters, instruments, relays, &c. In appearance it is exactly similar to an ordinary voltmeter, has the usual type of scale, and has three terminals marked A, B, C; it may be either of the moving-iron, induction or dynamometer pattern. It is provided internally with two magnetising coils, which act on the moving element, one coil being in series with an inductive resistance and the other with a non-inductive resistance. It is of simple construction and of the same reliability as an ordinary voltmeter, and only requires the same amount of current for its working. The accompanying diagram shows the connections as viewed from the front. In practice it is connected across the three secondary phases of the potential transformer, and it then performs the following functions:—

1. It indicates the voltage of the three phase circuits. 2. It indicates when a break occurs in the potential transformer, or its connections, and/or the failing of any of the fuses, whether it be a high or low pressure one. 3. It indicates which fuse has blown, or the particular phase in which the break may have occurred. 4. It indicates the direction of phase-rotation in the potential transformer secondary.

The indications are observed by means of special points marked (in colour) on the scale A, B, C and *a*, *b*, *c*. For example, in the event of a fuse failing on the high-pressure *primary* limb A of the potential transformer, the pointer of the instrument immediately falls from its normal reading to point A on the scale, *i.e.*, approximately 70 per cent. of the normal reading. Similarly, in the case of a fuse *a* on the secondary side of the potential transformer, the pointer would fall to point *a* on the scale, *i.e.*, approximately 50 per cent. of the normal reading; similarly, for faults on other phases the pointer will fall to other points, of great diversity, on the scale. In the event of the phases being in incorrect order, the instrument will only read approximately 57 per cent. of the normal; this enables one to see at a glance if, for instance, in the case where two single-phase transformers are used in "open delta," they are incorrectly "paired," or if there should happen to be any cross connections in a three-phase potential transformer, or even if the high-pressure mains themselves have been incorrectly "phased out."



Special Three-phase Voltmeter.

Undoubtedly these indications are most important where integrating watthour meters are used, as in the event of any of the above mentioned faults developing, the said meters would immediately become inaccurate, to a degree depending on so many factors (such as conditions of load, power-factor, &c.) that approximation and adjustment are difficult. This instrument in such a case gives a clear signal to an observer immediately on the fault taking place, thus enabling it to be rectified with the minimum of delay. It has also been found on several occasions that a prompt discovery of a faulty potential transformer winding has saved a complete "burn-out" and eventual "short."

It is, therefore, claimed that at a very slight extra cost, the instrument acts as a constant detector of faults that sooner or later are bound to occur, in addition to its duties as an ordinary voltmeter, which is an indispensable part of the equipment of switchboards and control gear of all descriptions; this has been fully borne out in practice, many of the instruments having given satisfactory service during the last six years.

Shop Photo-prints.—Why use the blueprint? Perhaps the experience of the writer, not on a large scale but on a scale big enough to give an idea of possibilities, would interest. The outfit includes a ¼-plate camera and a simple enlarging apparatus adapted to use the camera as a projector. The plates cost a few pence a time; cheap bromide papers 12 in. by 8 in.—4d. or so. Adding cost of chemicals, each 12 in. by 8 in. print will be worth when finished about 6d. You cannot reckon the plate, for that will last till the job expires, maybe years hence, and dozens of prints have been made therefrom. With accurate focusing the ¼-plate will enlarge to more than 12 in. by 8 in. if bigger prints are needed and give good enough results.

What do you save? Tracing, for the drawing need only be well pencilled in. Re-tracing, for the drawing need not be disturbed till you break the plate, provided you do not get a careless boy on the job; that is a matter of organisation only.

What do you get? Clear prints free from spiders' webs hiding important figures perhaps, or making 3s into 5s and scrapping work. Black lines on white, easier to read and less trying to the vision than white on a dirty brown or blue.

Consistent results can be obtained after a little experimentation, for all processes can be regulated by time and temperature methods. The aim should be to get the biggest possible contrast at all steps.—F. W. Shaw, in the *American Machinist*.

An Electric Vitreous Enamel Furnace.—A two-compartment electric furnace for baking vitreous enamel on resistance tubes has recently been installed at the Schenectady works of the General Electric Co.

The furnace is divided by a door which can be raised or lowered when a batch of tubes is to be transferred from one compartment to the other. These tubes consist of a grooved porcelain body, wound with resistance wire; the enamel is placed over this winding. The front compartment of the furnace is used as a pre-heater, where the tubes are held at a temperature of 570 deg. F. for six minutes. This is necessary, because if the body of the tube is subjected to too high an initial temperature, it will crack. The connected load on this compartment is 9 kW and the temperature is automatically controlled by means of a thermostat. When preheating is accomplished, the work is moved into the second or baking compartment by raising the door between the two compartments. In this compartment it is subjected to a temperature of 1,650 deg. F. for six minutes, emerging from it in a finished state. The connected load in the compartment is 24 kW, and the temperature is also automatically controlled by means of a thermostat.

This furnace has not only saved time and floor space, but has improved the quality of the finished product and has reduced the percentage of defective tubes from 20 per cent. to less than 1 per cent.

Some interesting comparisons have been obtained with this furnace and an oil-fired furnace which it replaced. Working on two different classes of material—viz., push buttons and resistance tubes—it was found that the kWh per lb. of push buttons was 1.87, and the cost per lb was $0.023. For resistance tubes, the kWh per lb. was 0.541, and the cost per lb $0.006. The cost per hour of operating the oil furnace was 72 cents, since it consumed 6 gallons of oil costing 12 cents per gallon. The cost over the same period with electric heat was 41 cents, or a saving of 31 cents per hour in favour of the electric. It is estimated that production has also been increased approximately 50 per cent.—*Chem. and Met. Engineering.*

Service Notes.—Commander H. E. H. Spencer-Cooper, M.V.O., has been appointed to the light cruiser *Raleigh*, flagship of the North America and West Indies Station, for wireless duties, on the Commander-in-Chief (Vice-Admiral Sir William Pagenham, K.C.B.) hoisting his flag. A commissioned or warrant electrician for service with the Australian Navy is required for a period of two years. The electrician so chosen will be in all respects in the same position as if serving in the Royal Navy, in which he will take his turn of promotion. Lieut. J. E. Parnall, from the Tyne Electrical Engineers, has been posted in the same rank to the Regimental list of the Territorial Reserve.

The Minister of Transport.—Sir Eric Geddes has left London for Scotland, and the consequent rearrangement of duties will, it is expected, lead soon to the appointment of Mr. Arthur Neal as Minister of Transport in succession to Sir Eric. Mr. Neal, who is nominally Parliamentary Secretary to the Ministry, is already virtually the Minister in charge. In time the Ministry is destined by the Government to become a department of the Board of Trade, but for the present its status as a Ministry is determined by Act of Parliament.

Radium in Czecho-Slovakia.—In order to increase the annual output of radium in the country, which at present is only one gramme, the Czecho-Slovak Government has granted twelve million crowns for the technical improvement and enlargement of the mines. The annual output is expected as a result of these developments to reach four grammes, of which 1.2 grammes will be used for educational purposes and 0.8 gramme for medicinal purposes in Czecho-Slovakia itself. The remainder will be lent to foreign countries.—*Reuter's Trade Service* (Prague).

Defence of "Straphanging."—It is considered, states the *Morning Post*, that straphanging is a necessary evil in the present conditions of London traffic. It had been imagined that the time was approaching when there would be sufficient rolling stock to carry all passengers with comfort, but the authorities catering for this public need cannot fulfil this expectation, and are urging the necessity for permitting "straphanging" as a permanent feature of travel in London. The views of the traffic authorities were voiced by Messrs. H. E. Blain, A. L. C. Fell, and A. V. Mason on August 31st, when the Assistant Commissioner of Police received them at Scotland Yard. It was pointed out that congestion in some of the principal City streets would be still further increased by the abolition of "straphanging," and the public seriously inconvenienced. The Assistant Commissioner of Police promised that careful consideration would be given their representations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The marriage took place at Chapel Street Wesleyan Church, Luton, on August 22nd, of Mr. J. E. Burrows, technical representative of Gent & Co., Ltd., electrical engineers, of Leicester and London, and Miss Ida Maud Bennett, only daughter of Mrs. Bennett, of Napier Road, Luton.

Messrs. John Sterling & Co., of 66, Victoria Street, state that they are no longer acting as consulting engineers for the Bourne End & District Electricity Corporation.

Obituary.—We regret to learn of the death of Mr. Peter Cooper Hewitt, which occurred at Neuilly on August 25th. Mr. Hewitt was the son of A. S. Hewitt, a former mayor of New York, and a member of Congress; his mother was the daughter of Peter Cooper, a well-known American philanthropist. Peter Cooper Hewitt was educated at the Stevens Institute of Technology, Hoboken, and at Columbia University, and having inherited a large fortune from his parents, he devoted his life to scientific research in several directions, achieving an international reputation.

Although he was perhaps best known in Europe in connection with the development and application of mercury vapour apparatus—the Cooper Hewitt lamp and the arc rectifier for the conversion of alternating to direct current—for the manufacture and sale of which he founded, in collaboration with Mr. George Westinghouse, the Cooper Hewitt Electric Company of New York and the Hewittic Electric Company of London, yet he was a contributor to scientific discovery in a diversity of fields from wireless telegraphy and telephony, to a special process for the electrical welding of steel. In 1903 the degree of Honorary Doctor of Science was conferred on him by Columbia University. He was at the head of mining, railway, and philanthropic societies, and associated with many organisations for the encouragement of Art. He was only 60 years of age at the time of his death.

MR. J. SWIFT.—The death has occurred at Helsby of Mr. Joseph Swift, one of the oldest employés of the British Insulated & Helsby Cables, Ltd., by whom he had been employed for 33 years, occupying the position of chief of the stores department.

Will.—The late Sir JAMES PENDER, chairman of the Aron Electricity Meter Co., Ltd., and of the Direct United States Cable Co., Ltd., and a director of the Electric Construction Co., the Globe Telegraph & Trust Co., and the Telegraph Construction & Maintenance Co., left £44,555.

NEW COMPANY REGISTERED.

Jones & Pordes, Ltd. (176,414).—Private company. Registered August 22nd. Capital, £1,000 in £1 shares. To adopt an agreement with A. E. Jones and M. Pordes, and to carry on the business of manufacturers of electrical batteries, accumulators, dry cells for bells and batteries, electric pocket lamp cases, lighters, and electric novelties of all kinds, motor and cycle accessories, metal press work, nickel platers and gilders, &c. The permanent directors are: A. E. Jones, Tavistock Residential Club, 38, Tavistock Square, W.C.; M. Pordes, 6, Stanley Road, Broadstairs. Qualification: £5. Secretary: M. Pordes. Registered office: 8, Crawford Passage, Farringdon Road, E.C. 1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Johnson & Phillips, Ltd.—Land registry charge on certain lands and premises in Charlton, dated July 29th (supplemental to trust deed dated July 1st, 1921, securing £350,000 first mortgage debenture stock). Trustees: Law Debenture Corporation, Ltd., and London General Investment Trust, Ltd.

McWhittaker, Ltd.—Debentures dated August 5th, 1921, to secure £400 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. McWhittaker, 48, Queensborough Terrace, Bayswater, W.

Morrell Export Co., Ltd.—Debenture dated August 17th, 1921, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Green, M.P., The Knoll, Old Normanton, Derby.

Ely Gas & Electricity Co., Ltd.—Satisfaction to the extent of £500 on June 18th, 1921, of debentures dated October 1st, 1908, securing £3,400.

Malleable Fittings, Ltd.—Debenture dated July 28th, 1921, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. T. Forrester, 65, Stanley Road, Hounslow.

British Illuminated Sign Co., Ltd.—Issue on August 17th, 1921, of £1,000 debentures, part of a series already registered.

Sloan Electrical Co., Ltd. (61,528).—Return dated August 17th, 1921. Capital, £60,000 in £1 shares (10,000 preference and 50,000 ordinary); 5,000 preference and 40,000 ordinary shares taken up; £38,500 paid; £6,500 considered as paid. Mortgages and charges: Nil.

South American Light & Power Co., Ltd. (74,446).—Return dated August 8th, 1921. Capital, £200,000 in £1 shares; 180,000 shares taken up; £130,007 paid; £49,993 considered as paid. Mortgages and charges: £136,400.

United Electric Tramways of Montevideo, Ltd. (80,456).—Return dated June 30th, 1921. Capital, £1,000,000 in £5 shares (100,000 preference and 100,000 ordinary); all shares taken up; £295,105 paid; £704,895 considered as paid. Mortgages and charges: £930,275.

Brush Electrical Engineering Co., Ltd. (29,533).—Return dated May 23rd, 1921. Capital, £600,000 in £1 shares; 458,563 shares taken up; £296,841 15s. paid; £161,175 considered as paid; £546 5s. remains in arrears. Mortgages and charges: £325,581 18s.

W. H. A. Robertson & Co., Ltd. (95,906).—Return dated June 6th, 1921. Capital, £36,000 in £10 shares (600 ordinary and 3,000 preference); 600 ordinary and 2,177 preference shares taken up; £25,620 paid (being £5 per share on 430 preference and £10 on 1,747 preference and 600 ordinary). Mortgages and charges: Nil.

British Electric Transformer Co., Ltd. (76,351c).—Return dated May 13th, 1921. Capital, £1,000,000 in £1 shares (300,000 preference and 700,000 ordinary); 300,000 preference and 325,000 ordinary shares taken up; £539,821 paid; £85,179 considered as paid. Mortgages and charges: Nil.

Ilfracombe Electric Light & Power Co., Ltd. (71,378).—Return dated June 27th, 1921. Capital, £15,000 in £5 shares; 77 shares taken up; £385 paid. Mortgages and charges: Nil.

United River Plate Telephone Co., Ltd. (23,654).—Return dated June 28th, 1921. Capital, £2,500,000 in £5 shares (324,000 ordinary, 40,000 preference, and 136,000 unissued); 324,000 ordinary and 40,000 preference shares taken up; £1,740,000 paid; £80,000 considered as paid. Mortgages and charges: £300,000.

British Mica Co., Ltd.—Mortgage dated July 30th, 1921, to secure £650, charged on 15, Cardington Road, Bedford. Holder: J. H. Howard, Clapham Park, Beds.

S. Gillatt & Co., Ltd.—Debenture dated July 17th, 1921, to secure £4,000, charged on company's undertaking and property, including uncalled capital. Holders: Albert Lee & Co., Ltd., 8 and 9, New Zealand Avenue, E.C.

Edison Swan Electric Co., Ltd.—Mortgage on certain lands and buildings in Ponders End and Winchmore Hill, dated August 24th, 1921, to secure all moneys due or to become due from company to Coutts & Co.

D. and J. Hill, Ltd.—Debenture dated July 25th, 1921, to secure £1,000, charged on the company's property, present and future, including uncalled capital. Holders: Smart Ad. Service Agency, Ltd., 3, Ave Maria Lane, E.C.

Rose Bros. Electrical Co., Ltd.—Particulars of £3,000 debentures authorised August 5th, 1921, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

Senatore G. Marconi presided at the annual general meeting at the Connaught Rooms, London, on August 24th. In dealing with the balance sheet, he said that the general reserve account figured at £4,001,368, which represented a very considerable increase in consequence of the premiums from shares having been transferred to that account. Having regard to the very large amount which now stood to the credit of this reserve account, they had not thought it necessary to make any provision for the big sum which they had invested in Russia, amounting to £375,000, but which they hoped they would not lose, nor in respect of the considerable advances which they had made to several of their associated companies during a time of great stress. They had every reason to hope that all these moneys would be not only recovered but productive of profitable results so soon as they might see the much hoped-for improvement in the trade of the world. Sundry debtors, debit balances and expenditure on foreign developments was some £564,250 more than it was in the preceding year, due to a number of matters which were under way, and from which results should be obtained in the future. Stock also showed an increase, amounting to some £166,000 in round figures, representing largely material which had not been invoiced at the end of the year. Approximately £51,000 had been added to freehold and leasehold property at home and abroad, and about £94,000 was expended during the year on long-distance stations and plant. Shares in associated companies and patents stood in the accounts as shown at their cost price. They were represented by £2,941,517, an increase of approximately £1,018,000 during the year. The shares were of a par value of £3,488,847, from which they hoped to see a steadily increasing revenue. Turning to the profit and loss account (which showed an actual balance for the year of £297,682), he said the balance of contracts and sales, traffic and trading accounts which represented the gross profit, was only £563,314, as compared with £946,997 in the preceding year, which in part accounted for the reduced profit, which was due to many circumstances. During 1920 they experienced a very serious depreciation in most foreign currencies, which had the effect very naturally of impeding the commerce of the world. The buying power of all Governments was greatly reduced, and nothing but what was immediately essential was contracted for. In the second place, the business which they did carry through in many countries showed substantially reduced profits in consequence of the fall in value of currencies, which were practically at their worst on December 31st last, when they closed their accounts for the year, but a substantial improvement had now taken place, and in the course of time they looked forward to further appreciation. There were also other disadvantages which their business had been under as a direct consequence of the war. It was for these reasons and others that the directors had resolved that it was best in the interests of the shareholders only to recommend a final dividend of 10 per cent. on the ordinary shares and 5 per cent. on the preference shares, carrying forward to the next account £820,567, and so preserve the cash resources of the company, which would enable them to take advantage of opportunities which might not recur. During the past twelve

months research, experimental work, and technical demonstrations represented an expenditure of approximately £84,000, plus a very substantial sum for patent fees. The nation had enjoyed the benefit of all this work and outlay year after year, but nothing yet had been received from the Government on the credit side of the account. All this was yet to come. They were doing their utmost to obtain settlements in respect of these matters, but they had to go by stages, and progress was extremely slow. Subject to satisfactory arrangements with the Post Office, they hoped, in the near future, to create telephonic services with several foreign countries, and provided they had the opportunity, as they hoped to have, of creating a wireless telegraphic service between here and Australia, it was quite within the realms of possibility that having the means of experimenting with their telegraphic stations they might thereafter supply Mr. Hughes with a telephonic means of communication with this country besides the direct wireless telegraphic service; but the one must exist before there was a possibility of the other. Considerable progress had been made in the perfecting of wireless telephones and the employment of them in aeroplanes plying between this country and the Continent. The whole of the British aeroplanes flying on the London-Paris route had been equipped with their system, and were giving most excellent service. There had been a certain amount of infringement of their patents in recent times which they had stopped in part and were taking steps to arrest entirely. They could not afford either the expenditure in research or patent fees and allow others to reap the benefits therefrom. Towards the end of last year they erected a temporary station in record time in Switzerland at Geneva for the purpose of conducting the Press service for the first Conference of the League of Nations. So satisfactory were the results of this demonstration that the Swiss Federal Government had granted to the company a concession for 25 years for the erection and maintenance of a wireless station in Switzerland to conduct international telegraph services. As that station could not be completed in time for the second meeting of the League of Nations to be held shortly the temporary station was being re-erected to conduct the Press service. The reasons advanced by the Swiss Government for granting that concession were that they had neither the knowledge nor the experience necessary to enable them to embark upon such an enterprise. They considered that by entrusting the work to a private organisation with full experience they would best serve the interests of their country. The company had taken over the administration of the postal and telegraph services, both wired and wireless, of the Republic of Peru; and in other countries in Europe and elsewhere they had a number of negotiations pending, and in some cases on the point of completion. In Canada they were looking forward to developments of an important nature.

Mr. Godfrey C. Isaacs seconded, and the resolution was carried unanimously.

A shareholder said that a few years ago they heard something of the Chinese business, but they had heard nothing of it that day. As he understood the matter, they were to have a monopoly of wireless telegraphy in China. The American Government stepped in and raised some objection to a monopoly to any other company. He would like to know what the position of this company was in China.

Mr. Godfrey C. Isaacs said they did enter into an agreement with the Chinese Government under which they agreed to join with them in the formation of a Charter in China for the conduct of wireless telegraphy work throughout China. The Chinese Government were to have half the interest in the company, and the company was to be given the other half for the benefit of its patents and its guidance and assistance in the work which was to be done. An American company subsequently obtained the right to construct a station in China. The company had protested, and the British Government had given it all the support possible. The matter had not been finally disposed of. But independently of that, the company was building three stations in China, the contract for which was entered into prior to the creation of the Chinese National Company.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting of the Tyneside Tramways and Tramroads Co. was held on August 30th at Newcastle-on-Tyne. Dr. J. T. Merz, who presided, said it was rather remarkable that they were able to pay a dividend at all. It was the smallest paid for some time, but considering the difficult times the company had gone through, the position was satisfactory. The reserve fund now stood at £38,898, which was less than the figure of 12 months ago. That was due to taking out of reserve some £2,000 for the improvement of the permanent way. This improvement was a special welding process which they were now carrying out. The decrease in the amount available for dividend was £3,209, which would be met by carrying to reserve £1,000 less, carrying forward £870 less, and paying £1,339 less in dividends. The report was adopted.

French Companies.

The Triphasé (Nord Lumière).—The report stated that the rise in coal prices, raw materials, and wages which marked the year 1920 had weighed heavily on the task of balancing cost of working, maintenance and first establishment. In the department of the Seine negotiations with the communes were being continued, without, however, leading to satisfactory results. In Seine-et-Oise more had been achieved, and the sanction of the Administration only was awaited. Various legal steps had, however, to be resorted to. After deductions for depreciation, the accounts for 1920 showed a profit of 2,091,706 fr., which, with the carry over of 1919, made a total of 2,184,926 fr., from which a dividend of 30 fr. per share was declared, payable from June 30th, less taxes.

Under the style of *Groupement des Compagnies d'Energie Electrique et d'Eclairage du Nord et de l'Est* has been formed a combination with a capital of 1,000,000 fr. to issue bonds guaranteed by the annuities owed by the State for war damages. The offices are at 94, Rue St. Lazare, Paris, and the combination comprises some twenty companies spread over the districts which suffered most severely from the ravages of the war.

Compagnie Parisienne de Distribution d'Electricité.—At the last general meeting of the company it was stated that the number of subscribers had risen from 132,600 in January, 1914, to 240,720 in December, 1920; the kWh consumption from 76,000,000 to 191,000,000; the new connections from 1,143 km. at the end of 1913 to 1,285 km. at the end of 1920. The rise was still in progress in 1921. A programme of new works to a value of 200,000,000 fr. was under way, comprising enlargement of stations, increases in their power, and construction of a new sub-station on the left bank of the Seine. The profit and loss account showed a deficit on working of 12,903,510 fr., increased by financial charges to 22,279,128 fr. This had been covered by drafts from the special account and the interest account, so that the creditor balance, with the addition of the profits carried over from former years, amounted to 6,818,771 fr. The agreement with the City of Paris allowed of the distribution of the greater part of this among the shareholders, and a dividend of 6 per cent. was proposed, payable from July 1st at the rate of 13.50 fr. per nominative share and 11.75 fr. per share to bearer.

Spanish Company.

La Electrica Popular de Vigo y Redondela.—The report for the year 1920, presented at the meeting in March, referred to the increase of capital, sanctioned in the foregoing December, namely, 2,000,000 pesetas, in 4,000 shares of 500 pesetas each, of which 1,500 had been taken up at par. The issue was intended to defray the cost of enlarging the steam reserve stations. The acquisition of machinery for the service of the tramways, the carrying out of works at the Lerez Waterfall, and the unification of the voltages on the lines of transport and distribution networks. Of the works mentioned in the report for the foregoing year, the enlargement of the Central del Oeste had been completed, and the new 700-h.p. Diesel motor group had been installed. The cost of the latter, with accessories, &c., totalled 351,048.12 pesetas. The 625-kVA alternator for this group, up to the date of the report, had not, however, been delivered by the Swiss makers, the Maschinenfabrik Oerlikon. The debt of the municipality of Vigo at the end of 1920 totalled 454,111.92 pesetas, after payment during the year of 203,624.66 pesetas. The profit and loss account showed an available profit of 336,661.08 pesetas, allocated as follows:—10 per cent. to reserves; 5 per cent. to management; 5 per cent. for statutory services; 204,328.88 pesetas to sinking fund; and 65,000 pesetas for a dividend of 6.50 per cent on 1,000,000 pesetas of ordinary shares. Compared with the foregoing year, the gross profits had increased by 116,480.21 pesetas, the receipts by 151,176,.45 pesetas, and the expenses by 965,806.87 pesetas.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—

Canadian General Electric Company.—$1,750,880 Common stock (and fractional certificates).

County of Southland Electric Power Board—£750,000 Guaranteed Six per cent. Debentures (guaranteed by New Zealand Government), issued at 96 per cent., 16 per cent. paid, and fully paid after issue of allotment letters.

New Issues.—*County of Southland Electric Power Board.*—Letters of allotment in connection with the issue of £750,000 6 per cent. debentures were posted on August 26th. It was over-subscribed nearly five times. The scrip went to a premium of 1 on the issue price of 96. The loan is to provide funds for the erection and equipment of the electric power station, most of the plant for which has been or will be purchased in this country.

Debentures in respect of the City of Auckland 6½ per cent. electrical undertaking extensions loan will be ready for delivery in exchange for scrip or allotment letters on September 5th.

The Bank of New Zealand is authorised by the *Thames Valley Electric Power Board* to receive subscriptions for £360,000 6 per cent. loan in debentures to bearer of £100 each, at £96 per £100 debenture. The principal and interest are unconditionally guaranteed by the Government of New Zealand, and are free from all New Zealand taxes, present and future, unless held by persons domiciled in the Dominion of New Zealand. The loan is issued to provide further funds for the purchase and construction of electric works throughout the Board's area in the North Island. The list will close on or before September 5th.

Victoria Falls & Transvaal Power Co., Ltd.—Net earnings (including those of the Rand Mines Power Supply Co.) for the quarter ended June 30th amounted to £203,041, before providing for taxation.

STOCKS AND SHARES.

TUESDAY EVENING.

THE centre of Stock Exchange interest is shifting from the pivot of investment on to the more or less unsteady ground of speculation. For some reason difficult to define the attractions of speculation are making something of an appeal to those people who hitherto have been content to put money into purely gilt-edged stocks. Stock Exchange business has started, very faintly, to revive. Some people ironically attribute this to the fact of the holidays drawing to an end, involving the annual necessity for attempts to be made to replenish bank-balances depleted by hotel bills, &c. About the greater willingness on the part of the public to venture into speculative fields, there is no doubt. It remains to be seen whether the buying which is taking place in the speculative markets will be of much practical benefit to those who take an optimistic view in regard to the general settlement of world conditions and increase of trade. The austere will doubtless point to the fact that business is reviving but slowly, and that the United States, where activity is likely to make appearance first, does not report anything startling in the way of improved conditions.

The war is now over, officially speaking, and those who have pre-war obligations which are still open under the various measures of protection that came into force in August, 1914, are faced with the knowledge that they must liquidate, or shoulder, their responsiblities within the next twelve months. What effect this is likely to have upon markets in the Stock Exchange it is difficult to estimate. The pre-war account in stocks and shares has been closed down to the extent, probably, of 90 per cent., but the other 10 per cent. is a troublesome legacy, and its completion may give a certain amount of trouble that will find reflection in realisations of existing stocks and shares in order to wipe out the pre-war liabilities. So far as can be seen, the fact of a whole year being available for paying-off these old scores will enable operators, and other debtors, to make their arrangements without any unfavourable effect being exercised over Stock Exchange markets. We must expect to be told, a good many times within the next twelve months, that liquidation is the cause of what there may be of dulness and depression in markets, when no other reason is assignable for the heaviness.

The market in new issues is little affected by the prospect of further newcomers in the near future. The Southland (N.Z.) Electric Power 6 per cent. debenture stock, issued at 96 with the guarantee of the New Zealand Government, was promptly over-subscribed, and a premium of about a point became established at once. This is followed by the offer of £275,000 similar stock, also with the New Zealand guarantee, by the Thames Valley Electric Power Board. There was brisk demand for underwriting. The credit of New Zealand stands particularly high, so that any industrial company which is successful in obtaining the guarantee of the colony can be assured of a welcome in the money market. Indian industrials are a shade easier by reason of the riots that have broken out.

Metropolitan Electric 7½ per cent. debenture stock and North Metropolitan 7½ per cent. debentures are both 7½ premium. The Shropshire debenture, after being down to a small discount, is now ¼ premium. General Electric 7 per cent. debenture stock is a good market at 95 buyers. There is on offer at the present time a small amount of Bournemouth & Poole Electricity 7½ per cent. seven-year notes at 101, free of stamp duty. Interest is payable on January 1st and July 1st, and the notes are redeemable in July, 1927, at par, or at any time after July next year by drawings at 102. The company's financial record for the past 10 years, and the fact that last year's profits would approximately cover the interest on the seven-year notes four times over, make these worth noticing by investors on a look-out for a security of this class.

Yorkshire Electric Power 5½ per cent. redeemable debenture stock is on offer at 85¼, free of stamp, with interest payable April 1st and October 1st, the present price carrying half a year's dividend. The security, in this case also, is well covered.

The market for Home Railway stocks is generally better, but Undergrounds are hanging back in the improvement that has carried up prices of the steam issues. Central London Assented ordinary has fallen a couple of points. Metropolitan at 26 is 1 higher, and Underground Electric ordinary gained ¼ at 2¾. City and South London Senior preferences at 57½ are up 2; the 1901 stock strengthened to 56 and the 1903 to 55. There has been a small inquiry for East London Prior Charge stocks without, however, having any quotable effect upon prices.

Foreign railway and tramway descriptions show comparatively little change. British Colombia Electric deferred is a point down, but the preference hardened to 60. In the Mexican group, Mexico Tramways 5 per cent. bonds at 58 are 3½ higher, in consequence of the payment of the March 1915 coupon, which, as already pointed out here, can be sold at a substantially better price in the Stock Exchange than is paid by the bank over the counter. Mexican Light & Power bonds have gone back to 51½, interest in them having subsided now that the string of eleven coupons has been duly met. There has been some exchanging of these bonds by holders who have put the money into Mexico Tramway bonds, the latter having of course, some 6½ years' coupons still overdue.

Electricity Supply shares are firm, with a rise of 5s. to 6½ in St. James' and Pall Mall ordinary. The manufacturing group, however, continues dull. English Electric preference at 14s. show a small fall, compensated by a recovery to 11s. in the company's ordinary shares. Metropolitan-Vickers fell 2s. 6d. to 1 11/16. Edisons are nominally 8s. 3d., though actually the price is not so good as this. It may be that the talk of apprehended German competition in this trade is being rather overdone. Cable manufacturing shares are inclined to be better, with Siemens 1/32 up at 23s. 1½d. Cable stocks and shares are quietly good. Great Northerns at 24⅜ are 5s. higher. Globe preference rose to 9½, though the ordinary at 16⅜ are easier. Marconis at 1½ are better; the price is ex 2s. dividend deducted last week. Other shares in the Marconi group are holding their prices.

Armament and engineering varieties are generally steady. Vickers ordinary, and the company's tax-free preference, both spurted on a rumour to the effect that the company is on the point of concluding a satisfactory termination to its claim against the Government. Armstrongs have advanced upon reports that the prospect for work ahead of the company is decidedly good. Iron and steel shares are better. The rubber market continues heavy. Next week there will probably be published the official details respecting the Rubber Shareholders' Association, to which the support of proprietors in rubber-producing companies is being invited. But so far the negotiations have had no influence in helping the prices of rubber shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price August 30, 1921.	Rise or fall.	Yield. £ s. d.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	4½	—	9 8 4
do. do. do. 4½ Pref.	4½	4½	3½	—	7 4 4
Chelsea	4	6	3½	—	9 4 8
City of London	13	14	1⅜	—	10 3 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 0
County of London	6	6	8½	—	9 5 6
do. do. 6 per cent. Pref.	6	6	8½	—	7 7 4
Kensington Ordinary	7	9	4½	—	10 18 4
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2½	—	12 9 0
Metropolitan	6	7	3½	—	9 6 8
do. 4½ per cent. Pref.	4½	4½	2½	—	7 16 0
St. James' and Pall Mall	12	12	6½	+ ½	9 12 0
South London	6	7	2⅝	—	10 13 2
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	5¼	—	8 13 10
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	85½	—	7 0 4
do. Def.	1½	1½	17½	—	8 14 2
Chile Telephone	6	7	5¾	—	5 14 3
Cuba Sub. Ord.	7	7	7⅜	—	9 6 8
Eastern Extension	10	10	16⅜	—	6 2 0
Eastern Tel. Ord.	10	10	180½	—	6 2 0
Globe Tel. and T. Ord.	10	10	16⅝	— ¼	6 0 4
do. do. Pref.	6	6	9¼	+ ¼	6 6 4
Great Northern Tel.	23	24	24⅜	+ ⅜	9 16 8
Indo-European	10	10	30	—	8 6 8
Marconi	35	15	1½	+1/16	8 0 0
Oriental Telephone Ord.	13	13	2⅛	—	*5 16 8
United R. Plate Tel.	8	8	6¼	—	*6 10 4
West India and Panama	Nil	Nil	6/9	—	Nil.
Western Telegraph	10	10	15½	—	*6 1 2
HOME RAILS.					
Central London Ord. Assented	4	4	47½	−2	8 8 6
Metropolitan	1½	1½	26	+1	6 0 0
do. District	Nil	Nil	17½	—	Nil
Underground Electric Ordinary	Nil	Nil	2¾	+ ¼	Nil
do. do. "A"	Nil	Nil	6/6	—	Nil
do. do. Income	4	2	70½	—	*3 15 8
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	93	—	10 0 0
do. do. 2nd Pref.	Nil	5½	25	—	10 0 0
do. do. 5 % Deb.	5	5	64	—	7 16 0
Brasil Tractions	Nil	Nil	28	—	Nil
British Columbia Elec. Ry. Prior.	5	5	60	+1	8 6 8
do. do. Preferred	5	20/-	55¼	—	*8 11 2
do. do. Deferred	3	12/-	58	−1	*10 15 6
do. do. Deb.	4½	4½	69¾	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	58	+ 3½	Nil
do. 6 per cent. Bonds	Nil	Nil	25	—	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	5	51½	−2	9 14 2
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	3⅞	—	8 3 0
British Aluminium Ord.	10	10	17/6	—	11 8 6
British Insulated Ord.	15	15	1⅞	—	9 12 0
Callenders	15	15	1⅞	—	10 8 8
„ 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	14/6	−6d.	13 15 10
Edison-Swan	10	—	8/3	—	—
do. do. 5 per cent. Deb.	5	5	68	—	7 7 1
Electric Construction	10	10	16/9	—	11 18 10
English Electric	8	8	11/-	+6d.	14 11 0
Do. Pref.	6	6	14/-	−6d.	8 11 6
Gen. Elec. Pref.	6½	6½	17/6	—	7 13 0
do. Ord.	10	10	20/-	—	10 0 0
Henley	15	15	1⅞	—	10 5 0
do. 4½ Pref.	4½	4½	3½	—	6 18 6
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	11½	— ¼	9 9 4
Siemens Ord.	10	10	1⅞	+1/32	*8 13 2
Telegraph Con.	20	20	21	—	*5 14 1

* Dividends paid free of Income Tax.

A NOTE ON THE INTERCONNECTED-STAR METHOD OF CONNECTING THREE-PHASE TRANSFORMER WINDINGS.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

(*Concluded from page* 269.)

With the three-wire primary and four-wire secondary star/star connection the primary current corresponding to the secondary out-of-balance current flowing through any one phase of a four-wire system must flow through the primary windings of the remaining two phases, and as there are no balancing load ampere-turns on the secondary windings of these two phases the primary out-of-balance current acts wholly as magnetising current to such phases, with the result that the phase voltages of the two lightly loaded phases increase considerably, the phase voltage of the heavier loaded phase correspondingly drops, and the position of the neutral is considerably deflected. The angular distances between the phase voltages also become unbalanced. A delta connected secondary does not improve the conditions.

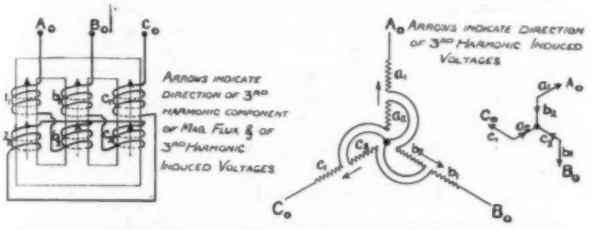

Arrows indicate direction of 3rd harmonic component of Mag. Flux & of 3rd Harmonic Induced Voltages
Arrows indicate direction of 3rd Harmonic Induced Voltages

Fig. 3.—Neutralising Effect of Third Harmonic Voltages.

If, however, the secondary winding is connected up in the interconnected star manner in which the winding on each limb is split up into two halves, the half of the winding on one limb being electrically connected in series with the half of the winding on another limb, any out-of-balance current flowing through one of the interconnected secondary phases is balanced by a corresponding primary current flowing through each of the two primary phase windings, the interconnected secondaries of which carry the out-of-balance current. As a consequence, the primary out-of-balance current has a perfectly free path through the two windings affected and the two-line wires, and the neutral is only slightly disturbed on account of the voltage drop due to the out-of-balance current. As with the delta/star arrangement there is no choking effect.

These remarks apply equally well to three-phase transformers and three-phase banks of single-phase transformers.

4. *Harmonics.*—It is generally known that on account of the variations in permeability with changes in magnetic density in the transformer iron, and also on account of the shape of the hysteresis loop, the m.m.f., and consequently the magnetising current wave form required to produce a sine wave of induction in the magnetic circuit will contain a third harmonic; if the third harmonic is absent from the wave of magnetising current it will be present in the induction wave, and, therefore, in the induced voltage waves.

As with a symmetrical star connected generator the third harmonic and its multiples are eliminated from the terminal voltages, it follows that they also will not appear in the applied line (or phase) voltages of the delta connected primary of a transformer, but third harmonics will appear in the wave of the magnetising current. Such a delta winding provides a closed short circuit path for the circulation of the triple frequency component of the magnetising current, and there exists no third harmonic voltage to neutral on the secondary star connected windings. Looking at it from another point of view, the triple frequency current circulating round the primary delta, supplies the third harmonic component of the magnetising current so that the wave of induction, and consequently the induced voltage waves are sinusoidal, and no third harmonic voltages exist.

Third harmonic voltages of any appreciable magnitude can only occur in single-phase transformers (core and shell type), and in three-phase shell-type transformers, as in each of these types the magnetic core presents a completely closed path to the third harmonic flux. They cannot be of any serious value in the usual construction of three-phase core-type transformers having three limbs, whatever the connection, as the resulting triple frequency flux instantaneously flows in the same direction in each limb, and so must take the return path through the air (or oil) and tank, this path being of very high reluctance.

When changing to a star connected primary, it is not permissible to retain the star connection on the secondary side, nor is a delta secondary desirable, as a neutral point is usually required for giving a four-wire supply or for earthing purposes. Both of these requirements, of course, can be obtained by artificial means, but it is better to incorporate them with the transformer secondary winding if possible.

By using an interconnected-star winding on the secondary side of the transformer the third harmonic voltages which are induced in the same direction in each half of the windings on each limb are eliminated from lines to neutral by opposition, as shown in fig. 3.

This, therefore, becomes an important feature *per se*, when dealing with single-phase shell and core-type transformers and three-phase shell-type transformers, but not so to any practical extent in the case of three-phase core-type transformers. It does, however, give an advantage even with the latter type, but is not a decisive factor in the selection of the interconnected star secondary.

5. *Availability of neutral point.*—As stated earlier, one of the chief features of the delta/star connection is that the neutral point on the secondary star connected side is available either for supplying a three-phase four-wire load or for earthing purposes. On the primary side, if a system requires earthing, this is usually done at the generator or by the creation of an artificial

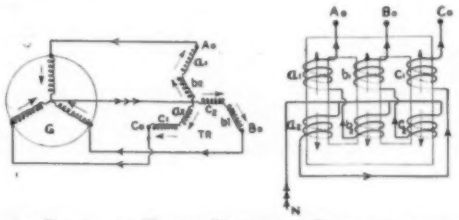


Fig. 4.—Paths of Third Harmonic Currents with Interconnected Star Transformer Primary Winding and Fourth Wire between Generator and Transformer Neutrals.

neutral point. With the star/interconnected-star connection a neutral point is available on both primary and secondary sides of the transformer, so that one still has the same facilities on the secondary side, with additional provision on the primary side for earthing if desired. This may at times be a very useful feature.

If the primary winding is connected in the interconnected-star manner and supplied direct from the generator, the generator and primary neutral points should not be connected together, either *via* earth or direct by a fourth wire. If the neutrals are joined a third harmonic current may flow in the fourth wire resultant from third harmonic voltages in the source of supply, and due to the splitting and interconnection of the transformer primary windings, the third harmonic exciting ampere turns, and consequently the induced e.m.f.'s

in the halves of the windings on each limb of the transformer neutralise each other, thereby providing a low impedance path (virtually a short circuit, so far as transformer reactance is concerned) for the flow of third harmonic currents. Such currents would only be limited in magnitude by the impedance of the generator winding and by the resistance of the connecting cables and transformer windings, and they would reach such large values in practice as seriously to overload the transformer and generator windings. Fig. 4 shows the paths of the third harmonic currents, and in both sketches the opposition of third harmonic exciting ampere turns in the halves of the windings on each limb of the transformer will be seen.

In conclusion, it may be interesting to show how the pressure distribution varies in the interconnected windings at different parts of each cycle. Fig. 5 shows this distribution during one complete cycle at intervals of

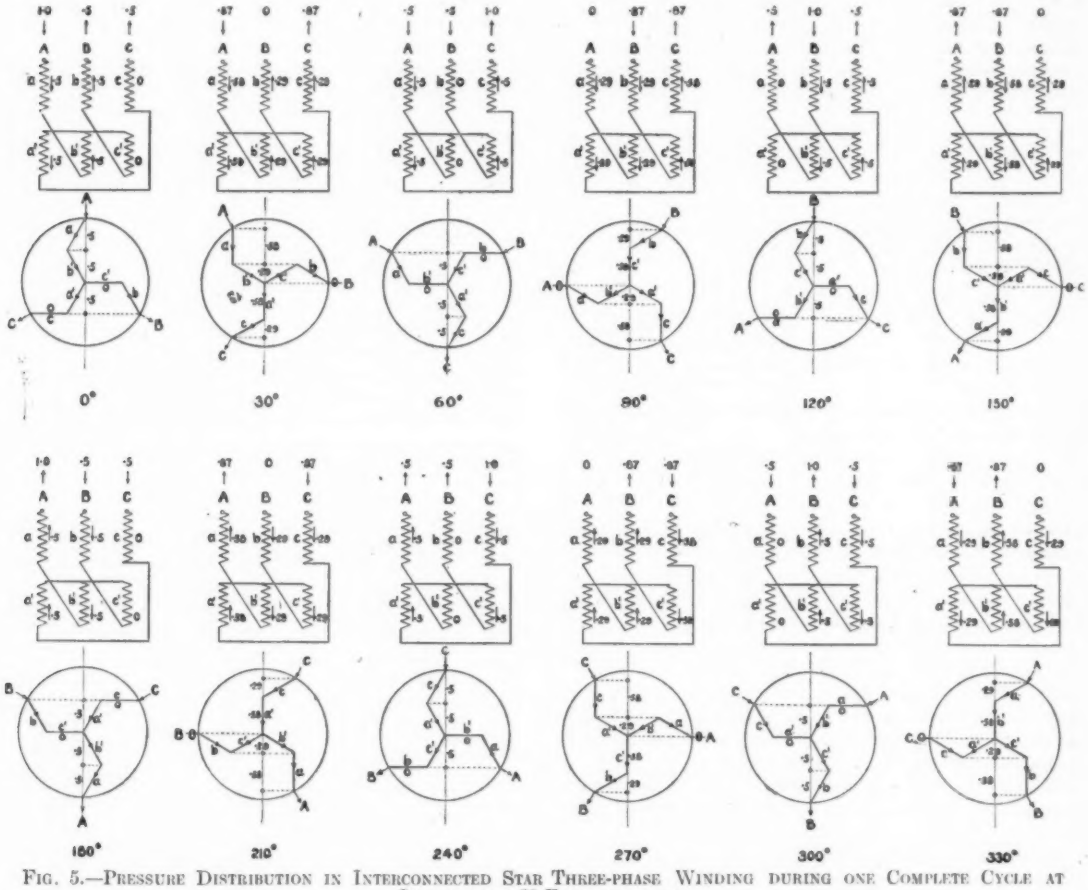


FIG. 5.—PRESSURE DISTRIBUTION IN INTERCONNECTED STAR THREE-PHASE WINDING DURING ONE COMPLETE CYCLE AT INTERVALS OF 30 ELECTRICAL DEG.

30 electrical degrees. The distribution at 360 degrees is, of course, the same as at 0 degree. The figure shows the winding diagrams with relative directions and instantaneous values of the voltages in each half-winding and in the lines, and also the corresponding positions of the vectors. The vector diagrams also show the distribution of voltage in the windings, together with their instantaneous values which are obtained by projection on to the vertical line passing through the centre of each diagram.

An American Copper Research Association.—Producers, manufacturers, and selling agents of copper and brass and their products in the United States, have recently formed a Copper and Brass Research Association. The principal object of the organisation appears to be not research, in the generally accepted meaning of the term, but to interest and educate the public in the advantages of the substitution of copper and brass for many purposes for which other materials are used at present. The head of the Association is Mr. R. L. Agassiz, of the U.S. Copper Export Association.

REVIEWS.

Factory Administration and Cost Accounts. By EDWARD T. ELBOURNE. Pages xx+811; 12 diagrams. London: Longmans, Green & Co. Price 45s. net.

The author is to be congratulated on not allowing this work to remain in *statu quo*. The book comprises seven main sections, and each section is further sub-divided; there are numerous diagrams, tables, and 166 specimen forms.

The author states in the preface that industrial conditions have permanently changed to such an extent as to induce him to start entirely afresh, on the foundation of his previous work (7th Reprint. Factory Administration and Accounts, first published April, 1914) to re-organise and re-write the whole book from beginning to end.

The work appropriately opens with a diagram of staff organisation and functions, and throughout the book a system of cross references is adopted, so that once the reader has found his particular subject through the index, he is automatically referred by marginal page references to other pages bearing on the same subject.

Section 1, "General Administration," illustrates lucidly manufacturing policy, and the conclusions arrived at, taking into consideration the altered conditions of industry since the pre-war state, form an interesting and valuable treatise on the facts. The choice of manufacturing policy, production efficiency, and programme is discussed in some detail; the author's comments upon staff-organisation and control, and the principles propounded, are both logical and a valuable commentary on modern administration methods. The sub-section on "Sales Management and Estimates" will at once appeal to the sales manager; the subject is dealt with in a general manner. No industry in particular is described, and the principles could be adopted in any industry, either large or small. "Correspondence" forms an important section, dealing with general responsibility and routine, filing systems, and internal correspondence, and the recommendations if carried out would obviate many of the slipshod methods very often employed in some otherwise highly organised works.

Under "Insurance," not only is the question of fire insurance dealt with, but also insurance against loss of profits through fire, a contingency that has probably not received the consideration it merits. Workmen's compensation, plant insurance, superannuation funds coupled with life insurance, sinking-fund policies, fidelity guarantee, and goods in transit are also dealt with. This section concludes with routine organisation, that is, duties of a regular nature that are re-

quisite for administrative and commercial purposes. Section 2, "Production Control," comments admirably on the selection of a factory site, availability of labour, power supply, transport, &c., and contains instructive diagrams of lay-out of administrative buildings; it also describes the general arrangement of a factory, factory construction, lighting, heating and ventilation, and plant lay-out. A sub-section deals with the organisation of pattern stores and records. "Production, estimating, rate-fixing," gives an interesting account of the important process of fixing job rates, suggestions *re* piece work and premium systems, and manufacturing operations. "Tools and Gauges," "Production Regulation," and "Foremanship and Inspection" are fully covered.

Section 3, on "Labour Administration," deals with a subject of the first importance, and the author has spared no effort to make a concise exposition of the matter. He states that of the most important official reports in this connection, two are of outstanding value, viz., the Memorandum issued by the Garton Foundation in October, 1916, and the reports of the Whitley Committee, issued in March, 1917, and copies of these reports are given, together with the functions of Works Committees, &c. A sub-section on "Government Regulations" refers to certain Acts which have an intimate relation to labour administration. "Trade Union Agreements" comments on collective bargaining, and gives specimens of various agreements between federations and unions.

"Working Conditions," "Principles of Remuneration," "Selection and Training of Workers," and "Works Regulations" form the subjects of other sub-sections.

Section 4, "Material Control," is a practical and careful analysis of the principles relating to purchasing, and contains interesting sub-sections on the principles of "Stores Organisation," "Warehouse Organisation," and "Dispatch."

Sections 5 and 6, "Administrative Records" and "Cost Accounts," cover in a most thorough manner all matters relating to works accounting, and conclude with an interesting chapter on "Cost Returns."

In Section 7, "Specimen Forms," the author deals with this subject with his usual distinctness, and makes specific recommendations for universal application under all conditions. Cross references are given to all those pages where forms have been indicated as having some interest or application.

Under "Departmental Application of Specimen Forms" the various forms are scheduled and illustrated, and are grouped under the headings of officials and departments likely to be interested.

There are one hundred and sixty-six forms illustrated, dealing thoroughly with the complete business organisation of an undertaking, and covering practically every departmental requisite. The forms are notable for their lucidity and utility, and no pains have apparently been spared in order to make them complete.

The work concludes with a comprehensive general index and a glossary appendix on the various principles dealt with; as the author states, some are admittedly old and well known, but their interpretation requires modernising, which is, in fact, the key-note of this interesting book. The work is of general excellence, dealing with the subjects in a practical manner, and it is a valuable book of reference to all interested in present-day problems of management.

Elements of Radiotelegraphy. By E. W. Stone. Pages viii+268; 158 figs. London: Crosby Lockwood & Son. Price 16s. 6d. net.

This work is essentially an elementary book for students commencing the study of wireless telegraphy. The author states that it had its origin in lectures given to radio classes for men in the American Navy, and considers that it may be found useful for instruction purposes generally. There are some 267 pages with well-prepared illustrations of which the clearness and detail leave little to be desired.

A noteworthy feature of the book is the description given of high-power Poulsen arc transmitting stations and plant used. Much of the more general information given is, however, of a disappointing character. Many of the usual fallacies which are handed on from text-book to text-book are repeated, whilst also errors, inaccuracies and unscientific explanations are much too prevalant. As examples the following may be quoted. The plain aerial transmitter is credited with being only able to give out highly damped waves, and that because the spark gap is included in the antenna circuit of the transmitter. The same reasoning should preclude the formation of prolonged oscillations in a Leyden jar discharge seeing that the spark gap is there, also, in the discharge circuit. The fact is, of course, that the damping can be made just as large or as small as we please, depending on the capacity of the aerial among other factors; the presence of the spark gap in the system being a matter of relatively small moment. In Article 105 the electrical resistance of the air or other gases is said to depend on the degree of compression, this being followed by a statement that when the molecules are not free to move about, no conduction can occur. In Articles 330 and 331, the fallacy of the high-resistance and therefore practically untunable coherer receiver is repeated. The fact is that the coherer is quite a sharply tunable receiver, and is normally an insulating device except in bad or wrongly treated specimens. The diagrams of connections given in Chapter X are nearly all incorrect and practically unworkable. The action of the Pedersen ticker used for continuous-wave reception is not clearly or completely explained, nor is that of the rotating or slipping contact device.

Advertising the Technical Product. By Clifford Alexander Sloan and James David Mooney. Pp. x+365. New York: McGraw-Hill Book Co., Inc. 1920. Price 30s. net.

The authors of this exciting book expressly state in their preface that they do not pretend, either to write a manual upon advertising methods, or to cover the whole subject of advertising the technical product. They believe that the science and art of advertising is, generally speaking, well understood, so that a manual is hardly necessary. In spite, however, of the numerous invitations to "learn to write advertisements," and the glowing prospects held out of the wealth to be gained thereby; and notwithstanding the undeniable advances lately made in advertising practice, both from the scientific and the artistic point of view, there is still much to be done in the direction of adapting particular advertisements to particular products or markets. Dedicating their book "To the man who pays the advertising bills, the manufacturer of technical products," the authors, whose experience and knowledge of their subject is considerable, attempt (successfully, in our opinion) to show how technical advertising may be made better, more attractive, and more efficient in the obtaining of business.

In such a country as America, where distances are very long, and railway journeys frequently occupy several days, the cost of sending travelling representatives to make the product known, and to do the spade work as well as collect the results, is obviously much more serious than it is here, where distances are so much shorter. This, we think, is one of the chief reasons why advertising has progressed to so great an extent in the United States. Some developments of American advertising do not commend themselves—perhaps we should write, do not yet commend themselves—to the unreserved admiration of British readers; but no doubt this was true 20 years ago, when the positions were relatively the same. The great weight of advertisements carried by American technical journals seems to show that manufacturers feel they cannot afford to discontinue their insertions, but there is now, and has been for some few years, a considerable amount of advertising. Newspapers announce: "You will find many novelties among the advertisements in to-day's paper." Popular papers state that if the goods advertised in their columns fail to give satisfaction, either the advertiser will give back the money paid for them, or the proprietors will do so, and (presumably) will not accept advertisements for such goods from the defaulting advertiser. So we have reached a point where the advertisment is admittedly likely to be overlooked, unless those to whom it is addressed voluntarily assist with their goodwill.

This being so, it is of enormous importance to be sure that the advertisements are directed to the right end. How often do we find the whole purport of the message to be taken up —we had almost written "obscured"—with information about the goods themselves, when what really interests the prospective user is, what they will do in his service, and the manner in which they can be adapted to further his ends, by cheapening his costs and increasing his output, and in consequence augmenting his profits in a geometrical ratio.

We have called this an exciting book. If to be continually tickled by a new point of interest; if to be led almost breathlessly onward to the development of a point of view as unexpected as it is important; if to have new aspects of the subject suddenly revealed; if to find one's own views, which have perhaps been suspected, even by oneself, of unorthodoxy, confirmed for novel reasons, and yet again to find a pet theory knocked into the middle of next week—if these characteristics, which might almost describe a successful detective story, are those of an exciting book, then that distinction is merited in this case.

Not only do we find much that is of interest concerning the bringing of technical products in a suitable way before the favourable notice of the prospective purchaser, but there are many useful hints on the essential characteristics of house journals, both public and private. It is necessary to keep the staff and workpeople apprised of how they can best advance their employers' interests, but this can be done in a right way, as well as in many wrong ways. Our readers do not need to be told that we have rather a high opinion of human nature; and for this reason we think it offensive for an employer, whether firm or individual, to tell his staff to "get an hour's earlier start to-morrow morning," to "do it now," to "make one more call to-day than yesterday." The natural instinct of mankind is to give a square deal, and this instinct is strengthened, in the great majority of cases, during the process of coming to years of maturity. It is the unnatural who cheat and defraud, and the very existence of criminal courts and prisons is a symptom that the person who operates against the recognised natural principle is abnormal, and must be put outside the pale of ordinary society. Those whose interests are bound up together should work together. It is the business of the leaders, not to insist upon this necessity, but to show how it may best be accomplished.

We commend this book to all, whatever their state of education in matters pertaining to advertising, who have at heart the advancement of our engineering industry.

FUTURE PROSPECTS IN HUNGARY AND POLAND.

Hungary's principal asset is her capacity to produce foodstuffs. Other sources of natural wealth, such as oil, may possibly be discovered, but this is uncertain. Coal there is, but with the exception of that mined at Pécs (at present under the occupation of the Serbs, Croats, and Slovenes) of poor quality and insufficient. There are possibilities of obtaining power by hydraulic means, but these, again, have not been developed.

A few good harvests, together with sound financial economy, should, according to a recent report by the British Commercial Commissioner,* place Hungary in a fair way to recover her balance, always provided that the essential factors of internal as well as external peace are assured, and an unrestricted market with the neighbouring States is mutually arranged.

The coalfields yield but a poor quality of brown coal, similar to lignite, which therefore cannot be used for gasworks, foundries, domestic purposes, or express trains, without an admixture of better class material. Last year's production amounted to nearly five million tons, equal to 78 per cent. of the 1913 output. The annual requirements are estimated at 7,500,000 tons.

Certain raw materials which were available to Hungary before the war are now cut off, and unless supplies are obtainable from neighbouring States without restriction, Hungarian industries will be in serious jeopardy.

Goodwill to Britain.

Apart from the question of the rate of exchange, demand in Hungary is keen, and if British firms were willing to do business on consignment to first-class houses, a very fair trade would ensue. British houses have always had an excellent reputation in Hungary, but competition is likely to be keen in the future, especially from Germany. Machinery, hardware, small tools, and iron-mill products are some of the main branches which will have to be taken into account, and in order to secure a market, apart from such credit facilities as may be granted, the selection of good agents is a matter of utmost importance. Budapest, owing to its position on the Danube, will in all likelihood become a centre for transit trade eastwards. A large stock of goods of various categories could be warehoused or bonded for transit purposes as well as for local sale.

Electrification Schemes.

No electrification of the State Railways has as yet taken place, although its desirability appears to be generally accepted, but it is proposed to electrify an experimental line of 49 km. from Kelenfold-Adony and Prisztraszaboles, with a generating station at Budafok, near Budapest. This station is complete with a 4,000-h.p. installation, and one electric locomotive is under construction at the Ganz-Danubius works at Budapest. The system will be single-phase with overhead wire, and the local brown coal will be used for power generation. If good results are obtained, it is proposed to electrify about 1,400 km. of line.

Tramcars and tramlines in Budapest and other towns are in need of thorough overhauling.

In connection with a scheme to build a commercial harbour on the island of Csepel, south of Budapest, it has been proposed to take advantage of the 4½ metre fall of the river during its 60 km. run, and by building a lock at the northern end and one at the southern end of the so-called Soroksur arm of the river, to develop some 7,000 h.p. Foreign capital is also needed for this scheme, but although both British and French firms have examined the proposition, no definite offer has yet been made.

A preliminary concession has been obtained by a firm of Swiss engineers to harness a branch of the river near Pressburg (Bratislava) and Györ. This, if undertaken, would yield between 20,000 and 45,000 h.p. according to the state of the river, and would be of great value to the industrial town of Györ. A third river power scheme is proposed in the neighbourhood of Vacz.

As soon as financial conditions permit, telegraphic and telephonic communication will need to be set in order as, owing to the war, instruments are still sadly in need of repair.

Poland's Task.

Amidst a turmoil of internal and external political struggles Poland has been striving bravely to reconstruct her economic life. The turning point would come, it was believed, when the plebiscite in Upper Silesia was taken. Yet that event is over and uncertainty still prevails.

Poland reckoned to lay a strong foundation again for her manufacturing industries with raw materials from Upper Silesia if that territory became an integral part of the new State. The Commercial Secretary to H.M. Legation at Warsaw dwells upon this factor in Poland's future in the report which has been recently issued by the Department of Overseas Trade †

Whatever Poland may ultimately gain from Upper Silesia, she will certainly make a big bid for trade with Russia and other countries in Europe in the products of her textile and engineering industries.

The character of the latter is local and interests Great Britain only in so far as it will be possible in the future to purchase in the United Kingdom machinery for the extension of the existing plant and the erection of new ones. Before the war nearly all the machinery required in the metallurgical and engineering industries was imported exclusively from Germany.

Exact statistics have not yet been compiled, but the following figures give an idea of the present position of the industry:—

1. Number of rolling mills, foundries, &c., employing more than 20 workmen in operation at the end of 1920, 325; of these, 237 belonged to the Polish Metallurgical Association.

2. Number of workmen employed in 1920, 27,000; in 1913, 54,000.

The Starachowice Metallurgical Co. has entered into an agreement with the Creusot-Schneider Co. and Messrs. Vickers for the development of the company on a larger scale and the erection of munition works.

Electrical Engineering Industry.

In spite of the difficulties in obtaining metals and other materials necessary for this industry, various enterprising capitalists started factories for the manufacture of indispensable articles. Local factories are now able to supply insulated wire of small diameter, switches, safety appliances, insulating tubes with accessories, electrotechnical porcelain, electric lamps, &c. All these articles are of good quality, and, although the output does not cover local requirements, the industry is developing satisfactorily, and improvements are made in manufacturing.

Owing to the depreciation of the Polish mark there is no competition in this class of goods at the present moment, but there is no doubt that, as soon as the exchange improves, the Germans will throw on the Polish market their manufactures, of which they hold large stocks, and which were imported in large quantities by Poland before the war.

Import Trade.

The import trade is not likely to increase until conditions become more normal, the currency appreciates, and the buying power of the country is larger.

It is readily admitted that Poland will become a buyer of foreign goods in the future not only for her own needs but as a middleman for the Russian market. The Poles have an extensive and accurate knowledge of Russia, and should play an important part in the commercial and industrial regeneration of that country. German competition is likely to be very keen in this part of the world, as, having lost important colonial markets, she will probably devote special attention to the capturing of Polish trade. It is therefore essential not to consider the Polish market as a buyer of goods to be utilised only in Poland—the scope is much larger.

Competition.

German and other competition was not felt much during 1920; as regards the former, this was perhaps due to the enforcement of special regulations by which the export from Germany to Poland of a large number of articles was prohibited by law, but such goods as have been offered are cheaper than British-made goods.

With a view to competing successfully, it will be necessary for British traders, in the first instance, to adapt their goods to local requirements, to appoint local representatives of a good standing, with a thorough knowledge of the country, and to sell goods on credit, as soon as local conditions will justify the granting of it. In some branches it will be indispensable to keep stocks of goods in Poland to enable quick delivery with a view to overcoming the advantage which Germany, Czecho-Slovakia, or German Austria possess, owing to their more favourable geographical positions.

* H.M. Stationery Office, 1s. 6d.
† H.M. Stationery Office, 2s.

Severn Barrage Scheme.—The Ministry of Transport, in a communication to the Newport (Mon.) Development Association regarding the Severn barrage hydro-electric scheme, says that while it is impossible to state that the scheme will not be proceeded with at some future date, when financial conditions are more favourable, there is certainly no prospect of the scheme being carried out for some time to come.

The Water Power Resources Committee, it is added, recommended that a technical commission of inquiry should be constituted, but, in view of the financial stringency, it was decided not to establish a commission at present. The recommendation will be further considered when conditions are more nearly normal. In the meantime the Board, in conjunction with other Government Departments, proposes to collect such information and data concerning the Severn as may become available, with a view to its possible future utilisation.—*The Times.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Reflector for Show-case Lighting.

The "X-ray Scoopette" fitting sold by the British-Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C. 4, has been designed to meet the demand for a neat and effective lighting unit suitable for use in show-cases and shop windows which cannot be lighted from the top. The fitting consists of a "Scoopette" reflector (which is corrugated as shown

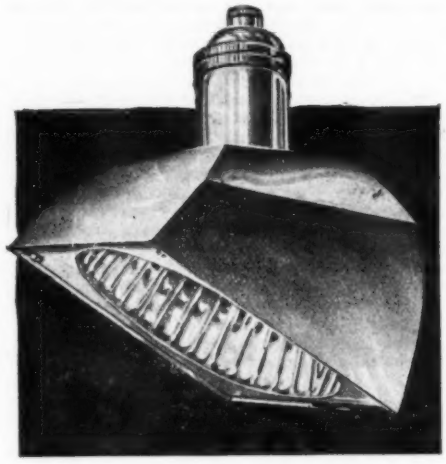


Fig. 1.—"X-ray Scoopette" Fitting.

in the illustration, fig. 1), a polished nickel or Florentine bronze casing and a bayonet-type lamp-holder. Two forms of casing, rectangular or elliptical, can be supplied—the former is illustrated. Special brackets have been designed for fixing these fittings to a wall or woodwork.

A Lamp-locking Device.

A new type of lamp-locking device has recently been placed upon the market by The Height Engineering Co., 33, Bridge Street, Manchester. As will be seen from the illustration (fig. 2), this consists of a brass cover which fits over the collar of the lamp, the shade resting on the top of the cover. Normally a locking nut is screwed down on to the top of the

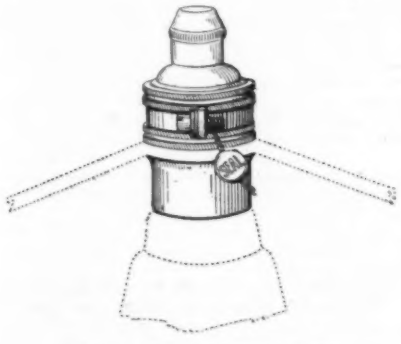
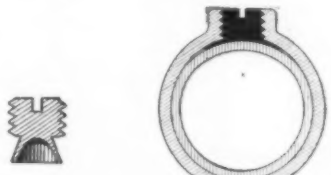


Fig. 2.—Lamp-locking Device.

shade, leaving a space on the screwed top. This is covered by a ring which can be slipped on to prevent the nut being turned to release the pressure holding the lamp on to the bayonet contacts. The ring is locked by a nut and screw and through the latter is drilled a hole for a sealing wire. The width of the ring can be varied for different types of lamp holders.

The "Terra-Grip" Continuity System.

A system has been introduced by Simplex Conduits, Ltd., Birmingham, to provide a cheap means of effecting ample and permanent electrical conductivity in light gauge unscrewed conduit installations. Each outlet of every fitting has a drilled and tapped boss for housing a steel screw of the formation shown in fig. 3. After the conduit is inserted into the outlet of the fitting, the screw is driven home, and, by virtue of its structure, the cup-shaped nose of the screw on making contact with the conduit expands, as shown in fig. 4. In expanding, the enamel is automatically scraped off the conduit, thus ensuring continuity. Further, the expansion of the cup-shaped nose automatically locks the screw in position, thus guarding against loosening under vibration. Conductivity tests on "Terra-Grip" junctions have been carried out by the



Figs. 3 & 4.—The "Terra-Grip" Continuity System.

Electrical Engineering Department of the University of Birmingham, by measuring the potential drop in millivolts across a number of "Terra-Grip" junctions in series. Currents up to 40 amperes were passed through the conduit and junctions, and the average resistance per junction was found to be only .0003 ohm.

A Tramcar Tire Heater.

A device (of Swiss manufacture) for heating tramcar tires, preparatory to fixing them on the wheels, which is being put on the British market by the Equipment & Engineering Co., 2 & 3, Norfolk Street, Strand, W.C.2, is a distinct improvement upon the types of heaters usually employed at tramway depôts and repair shops. As will be seen from the illustration (fig. 5), the device is a very simple one, consisting of a transformer with a removable yoke which permits of the placing of the tire in the magnetic field to form a closed secondary. The tire is placed upon a bed of insulating

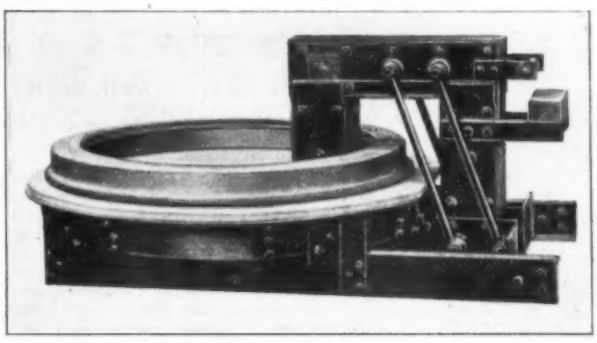


Fig. 5.—Tramcar Tire Heater.

material, and heats up very quickly. The yoke of the transformer slides in a guide, and is moved by means of a handle. The power required is about 25 kVA, and the desired temperature is reached in from 15 to 30 minutes, depending principally upon the size of the tire being heated. The apparatus weighs about 9 cwt. The only drawback to its use is the fact that an a.c. supply is not usual in tramway depôts, and of course this would involve the installation of the necessary plant.

We may mention that this appears to be an improvement upon a similar device made by the Oerlikon Co., of Switzerland, described in our issue of September 24th, 1915 (p. 393).

The "Universal" Electric Range.

A distinct advance in electric cooker construction is apparent in the "Universal" range, recently placed on the British market by Messrs L. G. Hawkins & Co., 116, Charing Cross Road, W.C. 2. This cooker is shown in fig. 6. The first point which strikes those who have to do cooking is the height of the appliance which does away with the stooping necessary in the case of most cookers, whether electric or otherwise. The overall height is 61 in. In appearance the range is very neat, and the floor space it occupies very small, being only 27 in. by 29 in. The oven is of rigid construction and heat-insulated by means of high-grade "Sani-Therm" block which will not deteriorate with long service or under high temperatures. The lining is of "aluminised" sheet steel. The oven equipment consists of a broiling rack, two heavy wire racks, and drip pans. The amount of heat is adjustable through a large range, as there are two elements, each with a three-

heat control. There are three hot plates containing very simple but efficient elements, simply connected to the cables upon the under-side of the bottom steel casing. Each of the hot plates consists of an insulating block, an asbestos pad, and the top plate containing the element. These hot plates are also connected with three-heat switches. In addition, there is also a shelf which embodies a hot plate. The switches for these heating elements are

Fig. 6.—The "Universal" Electric Range.

arranged on the front board, and their construction is such that it can be seen at a glance which elements are "on" and which "off." The total (full-heat) loading is 7,660 watts, the oven taking a maximum of 3,500 watts. The range is made by Messrs. Landers, Frary & Clark, of New Britain (Conn.), U.S.A.

THE INTERNATIONAL TRAMWAY AND LIGHT RAILWAY ASSOCIATION.

First Annual Congress.

The International Tramway and Light Railway Association was founded in Nuremberg in November last. The greater part of the membership is German or Austrian, practically all the undertakings in the two countries having given the Association their support. The number of representatives of other countries is 72, made up as follows: Denmark, four; Holland, sixteen; Italy, one; Jugo-Slavia, two; Norway, six; Poland, two; Rumania, three; Spain, one; Sweden, six; Finland, one; Switzerland, twelve; Czecho-Slovakia, nine; and Hungary, nine. It will be noticed that of the nations of the *Entente* only Italy has a representative. The membership is apparently not confined to traction undertakings or their representatives, for in the list given by *The Electric Railway and Tramway Journal*, from which this information is taken, the names of companies which are concerned only indirectly with the industry appear.

The first annual congress took place in Vienna on May 30th and following days, under the presidency of Herr Ludwig Spängler, director of the Vienna municipal tramways. About 350 delegates attended, and the day prior to the opening was devoted to a reception and sightseeing in Vienna. Among the visitors were official representatives of the Austrian, Dutch, Swedish, and Hungarian Governments. In replying to a number of addresses of welcome, the president stated that the membership already exceeded 450.

During the first day's proceedings President Engineer Dr. Exner (Vienna) discussed the relations between transport and experiments. He began with a reference to the year 1840, which saw the birth of the first large railway in Belgium, described the various stages of development of technical appliances and experimental work as the traffic increased, and mentioned the obstacles which had to be overcome in effecting satisfactory arrangements.

Director Dipl.-Engineer van Putten (Amsterdam) spoke of the many difficulties which had had to be overcome in the construction of the Amsterdam tramways. The reclaimed land was below sea level and of a gravelly nature. The tramway track had to be laid on concrete topped with asphalt. Of the present 115 km. of track, 74 km. was laid on concrete. The extended area presented difficult problems for the tramways, and especially in respect of the intercommunal tramways. At present, although Amsterdam had 700,000 inhabitants, it had only about 59 km. of tramway lines, on which about 130 million passengers were carried yearly. The eight car depots and repair works of the tramways were all built on piled foundations—in fact most of the buildings in Holland were built on wooden piles. These piles often had a length of 13 metres and in some cases as much as 25 metres. These facts showed clearly that the cost of the foundation of any building in Holland must amount to 10 or 15 per cent. of the total cost of the structure.

Prof. Dr. Helm, dealing with the German light railways and tramways, said that at the end of 1916 (when the last statistics were published), the mileage was about 12,000 km. In the case of tramways, the metre gauge predominated, then came the standard tramway gauge, which was followed by the 75-cm. gauge. Other gauges were very little used. In the light railways the standard gauge predominated. The small increase in the length of the lines with other than standard gauge was almost exclusively due to the extension of the existing lines, and not to the building of new lines. Owing to the war, the formerly favourable economic position of the light railways and tramways had been greatly affected. Many had had to be closed down, and on others the traffic had had to be greatly reduced. The higher prices often made it impossible to maintain the lines and the rolling stock in proper order. This would require at least 2.35 milliard gold marks, of which 1.5 milliard gold marks would be required for the tramways. In Germany the State had attempted to support the lines which were in financial straits, but this attempt must be considered as a failure, as the 100,000,000 marks allotted was quite out of proportion to the requirements. Moreover, these contributions meant a complete sacrifice of independent working. It would be much more to the point to release the railways from compliance with agreements and Acts which were passed when the conditions were entirely different. Many economies could be effected in the working; thus, for instance, a series of experiments was being carried out with the object of reducing the quantity of the rolling stock required and its wear. The tapping of new sources of revenue was absolutely essential. Such new sources could be found in an extension of the goods traffic on tramways, in the storing of goods on railway land at the receiving or shipping station, but chiefly, however, in advertising.

Director Norregard (Copenhagen) gave an account of the history and development of the Copenhagen tramways. He said that it was in the year 1863 that the first horsed tramway line was put into operation. In the course of the next year or so no fewer than ten other tramway lines were built by private companies. In the latter part of the nineties, however, these little tramways were amalgamated by two large private companies, and the tramways were electrified. Meanwhile the oldest line had been acquired by English capitalists and was under English control, although the electrification had been carried out by German firms with German capital. In 1911 the Copenhagen Tramways Co.'s large undertaking was purchased by the municipality, and now all the systems were municipally-owned and operated. The total length of tramways was 91.6 km., and the rolling stock comprised 426 motor cars and 440 trailers. The tendency to travel by tramcar had increased rapidly in recent years. Increased fares, due to adverse economic conditions, had not given a satisfactory balance between revenue and expenditure, and severe economies in working were necessary.

Director Hultmann (Malmö) said that it was impossible to secure satisfactory results by further increasing fares; attention must be paid to economies in staff and in new purchases. He advocated an extended use of trailer cars and the introduction of the one-man car which was becoming common in America. The Malmö Tramway Co. had been experimenting with a car of this type so designed as to allow passengers to enter and leave the car at the same time. It was, as yet, too early to pronounce a judgment on the merits or demerits of this arrangement, as the period of experiment had not yet closed.

The session then closed, and in the afternoon visits were paid to the Meidling Works and to the Favoriten station of the municipal tramways.

On the second day, Directors Barth and Falkenburg dealt very fully with the Christiania tramways and light railways. The former said that in 1917 a prize was offered for the best scheme of co-ordination and organisation of the traffic facilities in the city and its suburbs. Thirteen projects—two of them foreign—were presented. The speaker described the successful plan, the main principle of which was to run cars from east to west, and to lay down in the centre of the city as many tracks as were necessary to avoid the delaying of passing cars. Outside the centre, the lines are carried as far as possible radially to the limit of the populated area and beyond, the terminal stations all being designed as loops. Between the residential quarters and the business part there will later be a ring line. Another outer ring will also be built. There will be branch lines to the harbour and railway stations for goods traffic. Altogether the scheme provides for 60 km. of new suburban lines and 34 km. of new city lines, estimated to cost, without rolling stock, at present prices, 100,000,000 kr. This scheme is being actively proceeded with. Director Falkenburg outlined the present position of the Christiania system. There were two companies serving the city, and the total route length of both was 36.3 km. There were 155 motor cars and 150 trailers each carrying from 52 to 68 passengers. In 1919 over 90 million passengers had been carried, as compared with 37 million in 1913, showing the

enormous growth of traffic which had taken place in recent years. The speaker gave statistics which showed that the cost of material and labour had risen to from four to six times the 1913 figures. The fares had necessarily been increased considerably.

Chief Engineer Tramm (Berlin) then dealt with the psycho-technical test of the fitness of motormen. He said it was necessary to test the sight (long or short sightedness, quickness, colour blindness), the hearing (sharpness of hearing, ability to locate sounds), general state of nerves and other movements such as trembling, &c., arm rotation, manipulation of the driving apparatus, staying power of the driver, attentiveness and presence of mind. With the test of fitness went hand in hand the training on the Taylor method, and the activity was regulated in accordance with given principles. It went without saying that in testing for fitness the humane point of view must not be lost sight of. The speaker described briefly, with the aid of slides, the testing and training methods applied in the case of over 2,000 employés, as well as the results obtained. He mentioned that out of 100 candidates medically passed, 20 to 30 per cent. had to be rejected after the test of fitness. The psycho-technical test of the fitness of drivers was an extraordinarily efficacious means for ensuring safe and economic working, as had been proved by experience on the Berlin tramways.

Director Lehmann (Cologne) laid down the broad lines for the amalgamation of transport undertakings in large German cities. He described the reasons that had led to the splitting of transport undertakings in these cities, the results being a number of independent transport undertakings, want of a general plan for the whole of the city, great variety of technical equipment, great difference in rates, and frequently want of facilities for quick, direct, efficient, and cheap travelling. Amalgamation of transport undertakings must be considered as the only remedy. The object of the amalgamation of transport undertakings would be to lay down a joint plan for the traffic, to improve the existing traffic connection, and to equalise and to reduce the rates as far as possible. Amalgamation ought to be dealt with by the municipalities to which the necessary powers would be transferred, and their task should be facilitated by the unification of State examiners and inspectors, and by suitable legislation. The amalgamated transport undertakings should be owned chiefly by municipalities, but worked privately.

Engineer van Nes (Vienna) dealt with automatic converter stations for electric railways, and with mercury rectifiers. He gave a general description of the object and arrangement of automatic converter stations with single-armature converters in America, and of automatic converter stations on the Brown-Boveri system. He also dealt with the successful converter station at Riehen, near Basle, for the Basle-Lörrach tramways. The mercury rectifier, its construction and use, were described with the assistance of a number of slides, and converter stations with distant control from a central station, and automatic rectifier stations, were also described.

On the third day Dr. Mattersdorf (Hamburg) dealt with the standardisation of equipment, and spoke of the work of the Union of German Tramways, Light Railways and Private Railways in this direction. Among the subjects dealt with by this union were voltage, motors, controllers, interior wiring, mechanical parts, collectors and rails. As regarded controllers, 18 positions with four different connections had been standardised. Four standard sections of grooved rails had been approved, and six sections of headed rails. Dr. Mattersdorf also spoke on "service," and emphasised the need for centralised management and careful supervision and upkeep. He recommended the formation of a special commission to deal with these problems.

Director Tobias (Budapest) described the experience gained on the Budapest tramways in the use of ball and roller bearings. His conclusions were that properly designed ball and roller armature bearings were superior to armature bearings with sliding friction as regarded reliability of working, and that considerable economies could be effected in lubricating material, as well as in the cost and attendance and upkeep of the bearings and of the motors, such economies soon paying for the cost of purchase, in addition to the interest, even in the case of bearings subsequently put in.

Director Albert (Crefeld) and Director Loercher (Stuttgart) also testified to the advantages gained by the use of correctly-designed ball and roller bearings.

Engineer Stehr (Vienna) gave statistics and general information about high-pressure direct current, about speed regulation by shunting, and about power and converter stations. He concluded by describing the possibilities of the use of high-pressure direct current for light railways.

Engineer Findeis (Vienna) dealt with railless systems, and considered this a cheap means of locomotion for districts with small traffic. With the assistance of slides he gave particulars of the various constructions of current collectors, such as the Schiemann, the Kohler, &c., of the construction of the cars, of the possibilities of electric overhead lines, and described some existing lines and their results.

In conclusion of the day's proceedings, officers and council for 1921 and 1922 were elected.

On May 30th, the members visited the principal depot of the Vienna municipal tramways, and inspected the various departments, shops, and products of that large establishment. They saw about 450 cars in the sheds, besides rail-cars, snow-ploughs, and other service vehicles, &c. Later the members were the guests of the City of Vienna, and were welcomed by Burgermeister Reumann in the Magistrates' Sessions Hall.

On Tuesday afternoon, June 1st, a visit was paid to the brown coal depot at Zillingdorf and the new power station at Epenfurt of the Vienna Electricity Department, as well as to the electricity works of the Southern Railway Co.; and on the following day the visitors inspected the modern works of the A.E.G.-Union Co., and the railless trolley installation between Potzleindorf and Salmannsdorf.

The next congress of the Association is to be held in Budapest.

SIGNALLING BY INVISIBLE RAYS.

Selective Transmission and Detection of Ultra-Violet Radiations.

Very little regarding the origin or detail of the invention which enabled signalling to be carried out by means of invisible rays during the later period of the late European war has been so far available. A recent issue from the U.S.A. Patent Office, however, "let the cat out of the bag" for, according to the *Electrical World*, the invention is claimed by Dr. Louis Bell and Mr. Norman Marshall, of Boston, who are reported to have attacked the problem many months before America entered the conflict, and to have achieved success following a brilliant series of research investigations.

The peculiarity of the system described is that it utilises not the radiations of very short wave lengths known academically as the ultra-violet, but rather a part of the spectrum to which relatively very little attention has been paid—that portion which lies between the extreme visible violet and the point at which radiation is strongly absorbed by glass. Very powerful radiation in this region, which roughly lies between 400 $\mu\mu$ and 350 $\mu\mu$, can be obtained from divers sources like the carbon, mercury, and magnetite arcs, but—what is here of great importance—the incandescent lamp, particularly hard pushed, yields very excellent results. Rays in this region are of extremely low visibility, so low as to be virtually invisible under all working conditions, and yet they have the power of exciting the "chemical eye" of fluorescence with somewhat astonishing efficiency.

Perhaps the most remarkable thing about the system is the extremely small quantity of energy required to operate it, less than 20 watts total output being ample for ordinary front-line work and 100 watts or so for distance signalling. Bearing in mind the fact that even this small amount of energy is filtered through half an inch of dark glass, the extraordinary sensitiveness of a properly organised "chemical eye" becomes strikingly evident. The retina itself, for visible rays, responds to amounts of energy so small as to be hardly imaginable, but the photochemical process of fluorescence, if photochemical it be, seems not to fall far behind.

All previous efforts to signal by normally invisible rays had attempted to use either the extreme ultra-violet or infra-red rays in the belief that the former were so quickly absorbed by the atmosphere, and so difficult to obtain in quantity as to be impracticable for portable service, and even less attainable in suitable transmitting apparatus. Moreover, every previous attempt to utilise ultra-violet light rays had involved the use of quartz apparatus which was utterly impracticable for production in quantity as required for military use. Therefore, Messrs. Bell & Marshall turned to the region just beyond the visible spectrum and instead of working with quartz lenses, the experimenters used ordinary Mangin mirrors, which by tradition were entirely incapable of dealing with the ultra-violet rays without vital absorption for the region now used (400 $\mu\mu$ to 350 $\mu\mu$). The Mangin mirror proved excellent for the work, and it was found possible to obtain a powerful beam in this part of the spectrum from an ordinary gasfilled lamp of the type used for automobile headlamps.

A suitable screen to cut out the visible spectrum gave the investigators a large amount of trouble, owing to the fact that nearly everything in the way of an absorbing medium is permeable to the red of the spectrum, of low visibility by day but conspicuous by night. The problem was to leave the nearer part of the ultra-violet and to transmit it with considerable freedom. Traditional screens failed utterly. Messrs. Bell and Marshall tested virtually the entire range of dyed films and liquid absorbing media, literally in hundreds of combinations, before success was achieved. The screen finally settled upon as the most practicable was a combination of glasses produced by the efforts of Dr. H. P. Gage, of the Corning (N.Y.) Glass Works, working on the specified requirements as to wave-length limits. Still more persistent investigation was required to discover the "chemical eye" which should finally render visible the radiation passed by the incandescent lamp through the necessary screens. To reach success it was necessary to have a receiving screen which should be very sensitive to the one particular region of the spectrum supplied and should fluoresce with the colour of the maximum luminosity value for very weak stimuli. Even when the best substance was finally found it proved to be a rather difficult art to prepare it in the sensitive films necessary for use.

The investigators had particularly in mind the production

of a very light and effective signalling set which had maximum portability so that it could be carried if necessary on a soldier's belt. The first complete apparatus turned out, in fact, consumed less than 20 watts derived from a dry battery carried on the belt and was capable of signalling probably over 1 or 2 km. In the receiving apparatus, again, all traditions were violated, for the "chemical eye" was fixed to an ordinary prism field glass where the rays had to pass through two cemented lenses and 6 or 8 cm. of glass. Glass, in fact, is quite transparent to the particular radiations employed, and ordinary field glasses form as good a receptive device as could be desired.

Finally, the whole outfit, with combined sending and receiving apparatus, battery, and tripod mount, weighed but 13.6 kg. and was capable of working over 6 or 8 km., using only about 25 watts in the lamps. It gave a singularly narrow and sharply defined beam, appearing in the receiving glass as a little green moon blinking a code unseen through the darkness.

Signalling with this particular kind of ultra-violet ray proved successful even in face of a drizzling rain or a snow squall. The absorption by the atmosphere did not appear to be at all severe, and the apparatus was extraordinarily compact and portable.

In the most developed form two telescopes are used side by side. One is used in transmitting and the other in receiving signals. In the former are mounted duplicate lamps, the filter, eyepiece, and transmitting lens. The latter contains a condensing lens, with the fluorescent screen at its focus, and an eyepiece. Clear glass was used in these lenses.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

21,163. "Electric colour-changing signs." E. W. Chamberlain. August 9th.
21,335. "Incandescent electric lamps." J. F. N. Young. August 11th.
21,342. "Dynamo-electric machines for producing oxides of nitrogen." F. Stacey. August 11th.
21,357. "Party-line telephone systems." R. C. M. Hastings. August 11th.
21,365. "Apparatus for condensing mercury vapour in metal-vapour rectifiers." Siemens-Schuckertwerke. August 11th. (Germany, August 19th, 1920.)
21,371. "Drawn wire filaments." General Electric Co., Ltd., and F. S. Goucher. August 11th.
21,438. "Electric emergency lighting installations." P. Das. August 12th. (Holland, October 28th, 1920.)
21,582. "Electric light fitting." J. Hall. August 15th.
21,584. "Terminal connectors for spark plugs, &c." B. Deakin. August 15th.
21,595. "Shade carriers for electric lamp holders." S. Coxon and F. M. Soulsby. August 15th.
21,600. "Clips or brackets for holding petrol cans, accumulator boxes, &c." J. H. Holland. August 15th.
21,612. "Electric floor-polishing machine and waxing attachment." G. E. Robinson, F. M. Soulsby, and R. A. Stencel. August 15th. (United States, May 23rd.)
21,624. "Dynamo-electric machines." J. A. Kuyser, Metropolitan-Vickers Electrical Co., Ltd., and R. Townend. August 15th.
21,680. "Electric lamp brackets or supports." Cable Accessories Co., Ltd., and F. H. Reeves. August 16th.
21,681. "Electric plug-and-socket connections, &c." J. A. Crabtree. August 16th.
21,683. "Electric switches." J. A. Crabtree. August 16th.
21,725. "Electric radiators." C. W. Marriott. August 16th.
21,742. "Means for connecting electric conductors to rails." British Power Railway Signal Co., Ltd., and H. E. Cox. August 16th.
21,755. "Electric revolution counters." Eversheds & Vignoles, Ltd., and J. C. Needham. August 16th.
21,757. "Electrical moving figure." L. R. Henson. August 16th.
21,761. "Means for increasing sound transmitted by telephones, &c." W. H. Higgs. August 16th.
21,779. "Safety fuses for miners' electric lamps, &c." E. Summerfeld. August 16th.
21,786. "Electric transmitters for automatic telegraphy." F. G. Creed and Creed & Co., Ltd. August 16th.
21,798. "Electric lanterns for signalling, &c." J. Eaton, Efandem Co., Ltd., and A. H. Williams. August 17th.
21,814. "Apparatus for testing magnetos, insulated plugs, &c. E. J. Davis. August 17th.
21,819. "Electric lamp holders." W. Barnett, B.S.T. Electric Fittings Co., F. Saunders, and P. J. Thompson. August 17th.
21,846. "Amplification and/or shaping of impulses in telegraphy." Eastern Telegraph Co., Ltd., and W. Gaye. August 17th.
21,847. "Selective telephone systems." R. C. M. Hastings. August 17th.
21,848. "Telephone systems." R. C. M. Hastings. August 17th.
21,853. "Telephone mouthpieces, &c." L. Whitworth and Dyson & Co., Enfield (1919), Ltd. August 17th.
21,855. "Process of manufacturing carbon filament for incandescent electric lamps." K. Nishikawa. August 17th. (Japan, September 12th, 1920.)
21,857. "Electric telegraphy." Eastern Telegraph Co., Ltd., and W. Gaye. August 17th.
21,858. "Sparking plug." F. Scott. August 17th.
21,859. "Electric connections between conductors." S. Cohen and J. Firth. August 17th.
21,864. "Safety systems for electric networks." Naamlooze Vennootschap Lijn-Protectie. August 17th. (Holland, September 16th, 1920.)
21,871. "Electric clutch coupling for dental technics." E. Huet. August 17th. (Belgium, November 20th, 1920.)
21,872. "Electrical precipitation." Lodge Fume Co., Ltd. (International Precipitation Co.). August 17th.
21,893. "Electro-magnetic engines or motors." H. F. Mordey. August 18th.
21,897. "Small electric motors." N. W. Bairstowe and W. A. Benton. August 18th.
21,933. "Electric motors." M. Kawarada and T. Yamamoto. August 18th. (Japan, December 7th, 1920.)
21,935. "Electric cut-outs." C. A. Damey and Kingsmill Electrical Co. August 18th.
21,947. "Telephones, phonographs, &c." A. S. Bowley. August 18th.
21,954. "Windings for dynamo-electric machines." W. E. M. Ayres. August 18th.
21,969. "Sparking plugs." Armstrong Sparking Plug Co., Ltd., and J. H. Im Thurn. August 18th.
21,986. "Dimming electric lamps of automobiles." G. E. Webb. August 19th.
22,000. "Mounting electrical apparatus on cycles." S. C. Westwood and H. B. Westwood. August 19th.
22,001. "Electric switches." S. C. Westwood and H. B. Westwood. August 19th.
22,005. "Apparatus for converting acetylene, paraffin, &c., lamps for use as electric lamps." C. Hewitt. August 19th.
22,019. "Tramway, &c., rails." E. W. Walsh. August 19th.
22,021. "Electric light fittings." Holophane, Ltd., and E. Stroud. August 19th.
22,026. "Miners' electric lamps." H. Wade (Concordia Elektrizitats Akt.-Ges.). August 19th.
22,032. "Magnetos for electric ignition." B.d.V. Motor Co., Ltd., and C. J. Coleman. August 19th.
22,035. "Connection for electric cable conduits." T. Clarke. August 19th.
22,040. "Instruments for producing interrupted electric current of controlled frequency." T. W. Booley. August 19th.
22,070. "Methods of measuring high voltages." British Thomson-Houston Co., Ltd. August 19th.
22,074. "Automatic trolley retrievers for electric tramcars." Chilian Electric Tramway & Light Co., Ltd. (A. Bowen). August 19th.
22,076. "Electrical fittings." W. M. Barrington, W. E. Bottom, and M. H. Goldfarb. August 19th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1919.

18,797. "Cooling of transformers or other electric apparatus." H. A. Carney and H. M. Lacey. April 22nd, 1920. (167,197.)

1920.

5,072. "Electrical apparatus for transmitting indications to a distance." M. P. Favre-Bulle and M. J. Lavet. February 19th, 1920. (167,204.)
6,344. "Combined lighting and ignition dynamo-electric machines." E. T. Ferat. February 6th, 1918. (139,780.)
6,345. "Combined lighting and ignition dynamo-electric machines." E. T. Ferat. October 15th, 1919. (Addition to 139,780.) (152,624.)
9,496. "Self-supporting electrical coils." De Forest Radio Telephone and Telegraph Co. April 4th, 1919. (141,344.)
10,943. "Telephone systems." Western Electric Co., Ltd. December 31st, 1919. (156,065.)
11,243. "Mercury vapour arc devices." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). April 22nd, 1920. (167,222.)
11,625. "Electric switches and locking devices therefor." R. K. Winning. April 27th, 1920. (167,231.)
11,658. "Impregnating paper and the like with insulating compounds and the like for electrical purposes." E. A. Claremont and C. J. Beaver. April 27th, 1920. (167,232.)
11,880. "Dynamo-electric machines adapted for synchronous working." L. J. Hunt. April 29th, 1920. (167,242.)
12,043. "Method of preventing loss of zinc in an electric battery." A. Pouchain. April 30th, 1920. (167,250.)
12,231. "Means for arranging electrodes in vacuum tubes." Edison Swan Electric Co., Ltd., and J. Scott-Taggart. May 3rd, 1920. (167,266.)
12,279. "Electric lanterns." Efandem Co., Ltd., and A. H. Williams. May 4th, 1920. (167,277.)
12,402. "Electric operated hammers." S. W. M. Kollock. May 4th, 1920. (167,286.)
12,482. "Slow-motion devices for electric rheostats and controllers." British Thomson-Houston Co., Ltd., and J. Sugden. May 5th, 1920. (167,291.)
12,999. "Dynamo-electric generator for lighting cycles and other road vehicles." Exact Manufacturing, Ltd., and H. T. Moores, May 11th, 1920. (167,305.)
13,194. "Telegraph printing systems." Automatic Telephone Manufacturing Co., Ltd., H. Harrison, and S. R. Smith. May 13th, 1920. (167,310.)
13,428. "Electrical heater for use in perforating and other devices." A. B. Campbell. May 15th, 1920. (167,316.)
13,673. "Manufacture of electrical collectors, commutators, controllers, interrupters, or the like." H. Herrmann. October 29th, 1919. (153,275.)
13,913. "Method of electrically welding together galvanised metal sheets, plates, and other parts." J. Ledwinka. May 20th, 1920. (167,327.)
14,687. "Terminals for electric conductors." G. H. Sykes. May 29th, 1920. (Cognate application 22,448, 1920.) (167,346.)
14,802. "Instantaneous electric water heaters." L. J. Schneider. May 31st, 1920. (167,348.)
15,124. "Sparking plugs." Brewster Goldsmith Corporation, Inc. June 9th, 1919. (144,632.)
15,336. "Automatic spark advance for magnetos." G. B. Gousset. June 20th, 1919. (145,404.)
17,723. "Process and apparatus for electrically separating dust from gases and vapours." W. North. August 27th, 1917. (145,585.)
18,139. "Means for coupling wires to electric lamp holders and other terminals." D. M. G. R. De La Pichardais. February 5th, 1919. (145,774.)
19,361. "Connecting clamp for electric wires." Allgemeine Elektricitats Ges. May 11th, 1918. (147,455.)
21,231. "Trolleys for electric tramways of the overhead conductor systems." W. Lawrence. July 14th, 1920. (167,374.)
21,341. "Electrically-driven vehicles." F. M. Walters. July 15th, 1920. (167,375.)
22,472. "Process for protecting against electrolytic destruction certain parts of apparatus which contain several liquid spaces." F. von Wurstemberger. August 2nd, 1919. (149,632.)
23,030. "Electric welding machines." J. Y. Johnson (United States Chain and Forging Co.). August 4th, 1920. (167,391.)
26,173. "Holders for electric incandescent lamps." D. M. G. R. De La Pichardais. (Addition to 150,726.) September 12th, 1919. (150,971.)
26,551. "Electric current generator for high voltage ignition and lighting." J. Gehrig. September 16th, 1919. (151,274.)
29,527. "Electrical wall plugs." A. Ten Bosch. July 23rd, 1919. (152,665.)
31,665. "Telegraphic tell-tale instruments." A. C. Nacneur. November 9th, 1920. (167,427.)
32,027. "Homopolar inductor alternator." Maschinenfabrik Oerlikon. November 28th, 1919. (154,893.)

1921.

2,432. "Bonding blocks for metal-covered electric wiring." A. Kirk and R. C. Miliken. January 18th, 1921. (167,436.)
8,519. "Magnetos." Soc. Duten Doublet et Cie. February 25th, 1920. (167,437.)
9,636. "Process for suppressing the higher harmonic currents in the secondary circuits of transformers feeding polyphase metal vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. April 1st, 1920. (160,833.)
11,829. "Method of manufacture of laminated magnetic masses provided with cooling vanes for electric machines." P. Hermann. April 4th, 1919. (Divided application on 142,838.) (162,281.)
17,014. "Wire clamping terminal for low-voltage installations." Scintilla. June 24th, 1920. (163,462.)